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For related information see also *Astronautics*.

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Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software.*

83 ECONOMICS AND COST ANALYSIS N.A.
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE 2203
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 2204
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences.*

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 2206
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 2207
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 2208
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance.* For space stations see *15 Launch Vehicles and Space Vehicles.*

92 SOLAR PHYSICS 2209
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 2210
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*

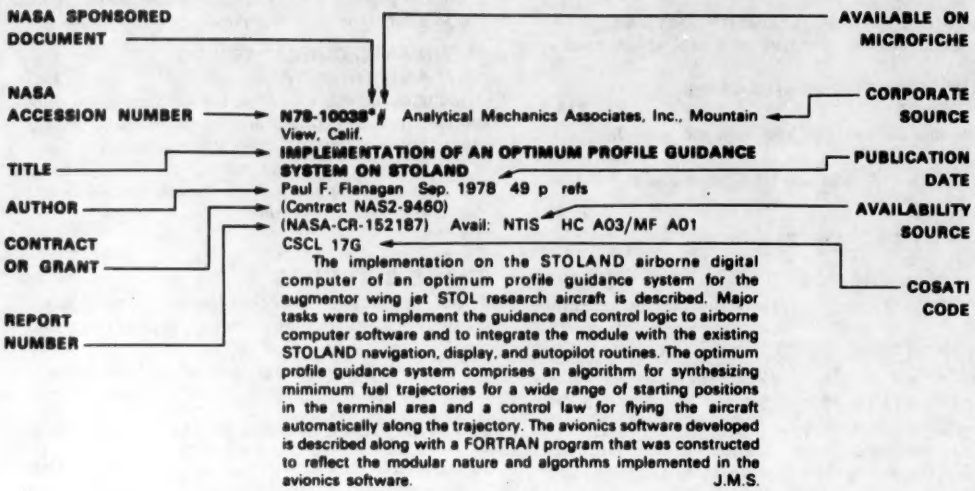
GENERAL

99 GENERAL 2210

Note: N.A. means that no abstracts were assigned to this category for this issue.

SUBJECT INDEX I-1
PERSONAL AUTHOR INDEX I-53
CORPORATE SOURCE INDEX I-61
CONTRACT NUMBER INDEX I-75
REPORT/ACCESSION NUMBER INDEX I-79

TYPICAL CITATION AND ABSTRACT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Analytical Mechanics Associates, Inc., Mountain View, Calif.
CORPORATE SOURCE
TITLE
IMPLEMENTATION OF AN OPTIMUM PROFILE GUIDANCE SYSTEM ON STOLAND
PUBLICATION DATE
AUTHOR
Paul F. Flanagan Sep. 1978 49 p refs
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The implementation on the STOLAND airborne digital computer of an optimum profile guidance system for the augmentor wing jet STOL research aircraft is described. Major tasks were to implement the guidance and control logic to airborne computer software and to integrate the module with the existing STOLAND navigation, display, and autopilot routines. The optimum profile guidance system comprises an algorithm for synthesizing mimimum fuel trajectories for a wide range of starting positions in the terminal area and a control law for flying the aircraft automatically along the trajectory. The avionics software developed is described along with a FORTRAN program that was constructed to reflect the modular nature and algorithms implemented in the avionics software.
J.M.S.

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, AIR-TO-GROUND COCKPIT DESIGN

F. Drsata, Rockwell International Corp., *International Airport, Los Angeles, California* (DF140000; F33615-77-C-3070)

This work unit supports AFSC development goal TW6. Advances in sensor technology and on-board computation capability could exceed the systems management capability of aircraft flight crews using existing control/display techniques. The objective of this work unit is to evolve guidelines for fighter aircraft crew stations designed to perform the air-to-ground weapon delivery task. Identification will be made of potential areas for subsystem integration that would relieve excessive crew workload and, at the same time, enhance mission effectiveness of the total weapon system. One specific objective is to provide cost trade-off data to help resolve the issue of crew size vs. mission capability.

Mission, threat, and functional systems analyses will be performed for candidate air-to-ground aircraft. Required mission performance characteristics will be assembled into a detailed mission scenario and specific system task requirements will be identified. Detailed crew task time-lines will be developed. A crew station mock-up will be constructed based on a design incorporating advances in weapon technologies, control and displays and optimized anthropometrically. Pilots from operational/user commands will evaluate the mock-up in a structured mission environment. Evaluation results will provide initial data on the appropriateness of the instrument configuration, crew procedures/checklists, and the trade-offs between crew size and avionics sophistication. Follow-on mock-up iterations and/or part task simulations will be used to assess developed guidelines.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0002, INTEGRAL FUEL TANK DESIGN HANDBOOK

J.W. Mahoney, Rockwell International Corp., *International Airport, Los Angeles, California* (DF142010; F33615-78-C-3212)

This work unit supports the Air Force's effort to reduce the life cycle costs of future systems. This is to be accomplished through improved design concepts and material selection for integral fuel tanks. The Air Force has experienced severe fuel leak problems from integral type fuel tanks. These problems have been caused partly by poor design practice and environmental degradation of sealant materials. This situation has resulted in a large number of continuing repairs being required for integral fuel tanks. The objective of this effort is to alleviate this problem through the publication of a design handbook which will document approved design details and materials for sealing integral fuel tanks.

It is felt that the basic data and information required to publish a handbook is available within the industry. Thus the first year's effort will publish a basic design handbook based on already available data. Future year efforts will update the handbook based on the data to be developed from other parallel programs which will develop improved designs and materials.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0003, DEVELOPMENT OF AN ENVIRONMENTAL DESIGN AND TEST GUIDE FOR ARMY ROTARY WING AIRCRAFT

R.L. Moonan, Rockwell International Corp., Aircraft Division, *International Airport, Los Angeles, California* (DA0D4006; DAAJ02-75-C-0043)

The objective of this effort is to review and assimilate induced and natural environmental data acquired from industry and government relating to current inventory Army aircraft for the purpose of developing the methodology to establish the environmental design and test criteria or to actually establish the design and test criteria applicable to future Army aircraft programs and to publish that methodology and/or criteria as a guide for designers and planners.

Following completion of an assessment of natural environment data by MERDC and induced environment data of Army aircraft by Boeing-Vertol, that data will be compiled and combined with other data to be used as a major input for the development of an Army aircraft environmental design guide. The design guide will be developed over five fiscal years- 75, 76, 77, 78, and 79. FY74 effort included the review and preliminary assessment of results of previous and current efforts being accomplished for this directorate by industry/other government agencies, and the establishment of a definitive program plan for future years. Funds will be transferred to various government agencies to defray required consultant service costs.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0004, WIND TUNNEL TEST OF LARGE-SCALE ROTOR HUBS - ANALYTICS AND EXPERIMENTAL INVESTIGATION OF THE AIRFLOW AND DRAG OF HELICOPTER HUBS AND PYLONS

R.W. Prouty, Summa Corp., Hughes Helicopters Division, *Centinela Ave. & Teale St., Culver City, California* 90230 (DA0E3783; DAAJ02-77-C-0055)

To improve the complex, turbulent airflow around helicopter rotor hubs and pylons, which causes localized drag and vibration, and which generates a turbulent, energetic wake which strikes the tail rotor, fin and tail boom, causing further aerodynamic problems.

Design and analysis of alternative shapes for hubs and pylons, using two current representative designs (YAH-64 and UH-60A) as baseline designs; test of these shapes in the Langley V/STOL wind tunnel at speeds up to 170 knots, using models to one-quarter-scale and eight-tenths scale. Models will be heavily instrumented to measure pressure distributions, forces and moments, with flow visualization and wake surveys providing off-body aerodynamic parameters.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0005, ADVANCED AIR TRAFFIC CONTROL
F.D. Queen, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN680218)

The near-term objective of the program is to establish a technology base in ATC to solve the problems of curved approach, flare, decrab, rollout, and taxi at tactical air fields under conditions of zero-zero visibility. The long-term objective is to provide a technology base for all-weather automated landings.

The technical approach to the near-term problem will include the assessment in the accuracy of aircraft attitude sensors, determination of measurement accuracies required in attitude and position, and development of sensors to meet the imposed accuracy requirements. Techniques using a variety of observables will be tested on a laboratory range or on an aircraft as appropriate. Development of the refined system for tactical aircraft will proceed using contractors.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Electronic Systems Command

1.0006, ASSESSMENT OF ARMY HELICOPTER COMPONENT DIAGNOSTIC ERRORS
D. Manahan, Cobro Corp., *10750 Columbia Pike, Suite 610, Silver Spring, Maryland* 20901 (DA0D4119; DAAJ02-77-C-0052)

To analyze and correlate Army helicopter maintenance data to determine the effectiveness and impact of current Army diagnostic and condition monitoring devices, procedures, and techniques to support Army aviation maintenance.

The contractor will develop an analytical procedure for assessing the effectiveness and impact of current Army helicopter diagnostic and condition monitoring devices, procedures, and techniques. Data required for the implementation of the analytical procedure shall be identified and acquired. An assessment of the data shall be made to identify deficiencies and inaccuracies.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Air Mobility Research & Development Lab.

1.0007, AVIATION WEATHER SYSTEMS
Unknown, Minority Services Inc., *Silver Spring, Maryland* 20910 (FA78WAI-881; FA161431 (TRAIS NO.))

The contractor shall furnish the necessary personnal, material, facilities, and services to provide systems engineering support in the development and testing of the Aviation Weather Systmem in accordance with the Statement of Work LGR-8-5338 dated January 16, 1978.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0008, TURBOSHAFT ENGINE BOOSTER STAGE DEMONSTRATION - ARMY AIRCRAFT
A. Brooks, General Electric Co., Aircraft Engine Group, *1000 Western Ave., Lynn, Massachusetts* 01910 (DA0E3806; DAAK51 78 C 0002)

Demonstrate the feasibility of incorporating a single-stage, constant speed, axial compressor within the integral separator of a turboshaft engine. This stage will supercharge the core engine and result in an significant increase in engine power (approximately 20 percent) with minimal change to the basic engine and will allow elimination of the scavenge blower.

Design, fabricate and experimentally evaluate, as an engine component, a combined booster stage and integral inlet separator. The program will utilize the T700 engine as a test vehicle to determine the impact of the booster/separator on engine performance.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0009, INTEGRATED AUTOMATIC FLIGHT/FIRE CONTROL SYSTEMS (FIREFLY II)
R.P. Quinlivan, General Electric Co., *P.O. Box 5000, Binghamton, New York* 13902 (DF135960; F33615-75-C-3143)

This work unit directly supports the mission of all current and future tactical fighter aircraft - to accurately deliver weapons on target, and survive. Improved weapon delivery accuracy and increased survivability will result in reduced combat losses, lower operating cost, and overall increased combat effectiveness. The overall objective of this effort is to increase aircraft survivability and improve the delivery accuracy of conventional unguided air-to-air and air-to-surface weapons through the integration of the aircraft's flight control and fire control systems. This effort will establish the desirability of integrated flight control/fire control systems and will establish the technology base for future efforts.

A variety of applicable techniques and configurations for interfacing the flight control and fire control systems will be defined and analyzed for a selected tactical fighter aircraft. Advanced designs such as direct lift and direct side force will also be addressed. Comparative analysis of weapon delivery accuracy for the various automatic and manual systems will be included. Results of the analysis will be confirmed by a detailed piloted simulation effort which utilizes the flying qualities of each aircraft/flight control/fire control configuration.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0010, MEASUREMENT OF FATIGUE DAMAGE WITH DIFFERENTIAL SCANNING CALORIMETRY
P.N. Adler, Grumman Corp., Grumman Aerospace Corp, *S. Oyster Bay Rd., Bethpage, New York* 11714 (DN590205; N00019-76-C-0651)

To establish the applicability of the differential scanning calorimeteric (DSC) technique of thermal analysis to monitor the structural reliability of aircraft during service.

DSC measurements are correlated with microstructural changes after varying degrees of fatigue exposure in two tempers of high-strength aluminum alloy 7050.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0011, EVALUATION OF DYNAMICALLY INSTALLED INTERFERENCE-FIT RIVETS
B. Leftheris, Grumman Corp., *S. Oyster Bay Rd., Bethpage, New York* 11714 (DN881379; N62269-77-C-0478)

To evaluate the fatigue life enhancing and crack growth inhibiting effects of dynamically installed, interference fit rivets and to attempt a theoretical prediction of these effects for use in design analysis. This work is in support of work unit ZA601, 'Aircraft Technology', Agency Accession No. DN 681080.

Both uncracked and precracked riveted joint specimens will be tested using both conventional and dynamically installed rivets. Fatigue life and crack growth rates will be compared. A theoretical prediction of the residual stresses produced by dynamic riveting will be made and linked to stress intensity solutions and crack growth prediction models.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0012, INSTALLATION OF F-14 COMPOSITE OVERWING FAIRINGS & MAIN LANDING GEAR DOOR
J. Mahan, Grumman Corp., *S. Oyster Bay Rd., Bethpage, New York* 11714 (DN881340; N62269-77-C-0385)

To install a limited number of composite main landing gear strut doors and overwing fairings on modified F-14 aircraft. This work is being performed as part of the service evaluation of composite structures being conducted to demonstrate the service durability and structural reliability of advanced fiber reinforced composite aircraft structures under actual Navy operational usage. This work is in support of work unit ZA601, 'Aircraft Technology', Agency Accession No. DN681080.

Five ship sets of composite overwing fairings and nine ship sets of composite main landing gear strut doors will be installed on Navy fleet F-14 aircraft. Since neither assembly is directly interchangeable with the current F-14 production part, the necessary nonstructural modifications to the aircraft in accordance with the installation procedures established under previous contracts will be performed prior to installing the components. At the completion of the installation operations, ground fit and function tests will be performed for each set of components. The composite components will be subjected to service usage and operational environments and their condition will be monitored during the life of the aircraft. The components will be removed periodically for laboratory tests. Kits will be provided for use by Navy personnel to restore the aircraft to accept the production metal components after the composite components are removed from service. (This contract covers only the installation of the components, not their manufacture or service monitoring.)

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0013, AERODYNAMIC ANALYSIS ON CAVITIES, 2-D AND AXISYMMETRIC BODIES

W. Calarese, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF138570)

A significant problem area of high-performance military tactical and strategic aircraft is the range and performance losses due to airframe-exhaust nozzle flow interactions. These losses are more significant in the transonic regime where nonlinear effects produce drag forces beyond tolerable limits. High drag and turbulence are also produced by open port turrets necessary for the use of such equipment as telescopes. The objective of this investigation is to develop a theoretical approach capable of analyzing the transonic and supersonic flow field over 2-D airfoils and bodies of revolution including jet plume, Reynolds number effects, shock-boundary layer interactions, boattail injection, and viscous mixing in separated regions, to provide quiet environment behind an open port, to minimize optical distortion and attenuation along a line of sight through the open port to some external point, to study laser exhaust flow and to obtain an overall drag reduction.

Numerical techniques, i.e., relaxation and/or time dependent, will be used to solve the transonic inviscid flow field. Boundary layer properties, jet plume effects, and mixing will be calculated with appropriate methods and incorporated in the solution. A computer program will be developed. Experiments will be performed in-house in the 2 ft tunnel over an already existing ogive-cylinder model with a metric porous boattail which allows mass injection, and with a plume simulator. Jet plume and Reynolds number effects on boattail and base drag will be checked, shock location and shock-boundary layer interaction will be analyzed as functions of boattail mass injection. Experimental wind tunnel tests will be conducted to achieve afterbody drag reduction by mass injection and to determine the magnitude and frequency of flow directions and various cavity geometries. Porous boattails, fairings, spikes, deflectors, and spoilers will be used to improve the external flow pattern and reduce drag and density gradients throughout the speed regimes.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0014, STRUCTURAL DESIGN CRITERIA SPECIFICATIONS AND DESIGN HANDBOOKS

G.E. Muller, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF131590)

To improve structural integrity and performance and minimizing the technical and cost risk associated with system development, USAF specifications and design handbooks require continual re-evaluation and upgrading to eliminate state-of-the-art limitations. New and updated strength and rigidity data requirements for the MIL-A-8860 series of airplane specifications, the AFSC design handbook series 2-0 for aeronautical systems, the MIL-M-8856 strength and rigidity specifications for missiles and the AFSC design handbook series 3-0 for space and missile systems will be developed.

Design requirements are developed and updated to meet current system deficiencies and projected needs for new systems through in-house application of completed research and the initiation of new research, as required. Deficient requirements to be evaluated and updated include airframe crashworthiness, bird strike damage, statistical wind design samples, and structural design aspects for V/STOL, RPV, and experimental aircraft.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0015, INVESTIGATION OF KEVLAR MATERIALS FOR DECELERATOR APPLICATIONS

W.R. Pinnell, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF136570)

Many military missions currently being performed incorporate a requirement for deployable aerodynamic decelerator systems to stabilize and/or recover special purpose payloads over a range including small electronic countermeasure devices and entire operational aircraft. The problem addressed by this effort is the reduction of the weight and volume required for decelerator systems. The objective of this effort is to integrate kevlar 29, a high-strength-to-weight fiber for textile materials, into decelerator system technology. Application of the kevlar 29 textiles will permit volume and weight reductions of approximately 50 percent when compared to currently used nylon materials.

Experimental kevlar parachutes will be tested in a controlled manner to determine proper design criteria for efficient kevlar 29 utilization. Test items will be 15.3 ft conical ribbon parachutes. Horizontal ribbons and suspension lines are the parachute components of primary interest.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0016, A/C FUEL TANK WALL RESPONSES TO HYDRODYNAMIC PRESSURES

S.J. Bless, University of Dayton, Research Inst., *300 College Park Ave., Dayton, Ohio* 45469 (DF140810; F33615-77-C-2082)

Combat survivability is a factor in developing an effective weapon system. A major cause of combat losses is the high vulnerability of aircraft fuel systems to nonnuclear threats. Aircraft fuel cells are susceptible to catastrophic fracture and rupture due to the intense pressure pulses immediately following impact by a ballistic projectile. The objective of this effort is (1) to develop a thorough understanding of the phenomenon (hydrodynamic ram) that causes this catastrophic damage and (2) to develop design criteria for combat-aircraft fuel-cells which can be used to inhibit or negate this damage, thus minimizing the vulnerability of the fuel tanks.

An analytical and experimental program will be conducted with a thorough analysis of each significant event beginning with projectile impact and continued as long as the resulting pressure pulses are intense enough to cause fuel-tank-wall catastrophic rupture/fracture/failure. Existing computer models will then be reviewed and/or modified for assessment methodology. Finally, the computer models will be used to develop families of design curves and design criteria which can be used to design aircraft fuel-tanks to inhibit or negate catastrophic failures resulting from the hydrodynamic ram phenomenon.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0017, AIRFRAME STRUCTURAL MECHANICS AIRCRAFT STRUCTURES

S.L. Huang, U.S. Dept. of Defense, Navy, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate, *Warminster, Pennsylvania* 18974 (DN133126)

Evolve engineering hypotheses for use in determining residual strength, fracture resistance and crack growth behavior in structures as means of ensuring structural integrity of naval aircraft.

Develop and verify crack growth models suitable for automated application for prediction of safe life and residual strength of metallic aircraft structures. Utilize and refine existing and

newly developed finite-element methods in the localized analysis of typical structural assemblies. Apply advanced analytical procedures to develop and numerically quantify new strength and failure theories for composites, and design and perform experiments to demonstrate the various phenomena. Fabricate and test representative composite structural specimens after exposure to various environmental effects and/or subject to low-velocity impact. Some of this work is being performed under contract, as reported in work units DG 602 B6, B8, B9, B11, B12.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0018, NAVY VEHICLE DESIGN AND CONSTRUCTION - LINE VORTEX GENERATORS

R.P. White, Systems Research Lab. Inc., Research Applied Science & Aeronautics Division, *1055 J. Clyde Morris Blvd., Newport News, Virginia* 23602 (DN475168; N00014-74-C-0091)

To develop predictive capabilities for the application of existing and new vortex control concepts to tactical aircraft wing design, and to investigate the static stability characteristics of aircraft that produce large increments of vortex-induced lift. Through control of the wing/vortex interaction, large values of incremental lift can be generated. This induced lift capability has the potential for large improvements in combat maneuverability through increased maneuver load factors and operation at angles-of-attack beyond the stall range of conventional wings.

The approach to developing the predictive capability for implementation of vortex control high-lift devices is through a systematic theoretical analysis and experimental investigation of the wing-vortex interaction. A potential flow theoretical model is being used to identify key parameters, analyze multiple wing-vortex interactions and develop design criteria for improved vortex control devices. Wind tunnel tests are being conducted to provide performance characteristics and flow field information to demonstrate improved vortex suction lift capability and to provide a data base for comparison with theory.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

1.0019, HT PP 78-09 - CERAMIC COMPONENT DEFINITION AND SCREENING - ARMY AIRCRAFT

J. Lane, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Applied Technology Lab., *Fort Eustis, Newport News, Virginia* 23604 (DA0E3812)

Conduct an investigation to assess applicability of ceramics for use in the helicopter gas turbine engine components, reviewing the limitations, design criteria, material properties, etc., required. Use of ceramics offers the potential of a 10 percent decrease in fuel consumption and a 30-40 percent increase in horsepower while reducing engine weight and cost over advanced technology engines for use in future Army helicopters.

To assess suitability of certain ceramic materials for use in Army gas turbine engines, primarily hot section components, by maintaining cognizance of the current programs in ceramics and considering potential benefits and man-rated risks in the helicopter environment. The documentation of this effort will include trip reports, memoranda for record and results of various symposia on the subject.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0020, HT RM 78-16 - ASSESSMENT OF TURBOSHAFT ENGINE R M FEATURES

Unknown, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Applied Technology Lab., *Fort Eustis, Newport News, Virginia* 23604 (DA0E3826)

The objective of this effort is to assess what reliability (R) and maintainability (M) features could be incorporated in small turboshaft engines consistent with the M environment envisioned for future Army aircraft. This program would identify specific R&M features that could be used on small turboshaft engines.

This program would include an assessment via a house task of what the M environment of turboshaft engines will be, a definition of typical future engine requirements i.e., potential future aircraft applications a definition of what m demonstration requirements for engines, how best to conduct R and M programs for engine development efforts, develop R and M features that can be incorporated in turboshaft engines and define module and line replaceable unit selection, servicing, cleaning, and diagnostics philosophy and/or requirements.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0021, STRUCTURES TECHNOLOGY

J.L. Shipley, U.S. National Aeronautics & Space Admin., Office of Aeronautics & Space Technology, Langley Research Center, *Hampton, Virginia* 23665 (DA0E3552)

To investigate helicopter rotor aeroelastic effects, resulting dynamic loading and vibration, maneuvering loads, and to develop analytical techniques for predicting these effects in existing and future Army aircraft. This technology is necessary to preclude the occurrence of these instabilities in flight regimes required of rotorcraft to enhance the safety, survivability, and mission effectiveness. In addition, design criteria will be developed and concepts tested which enhance rotorcraft capability without incurring dynamic limitations.

Research in rotor aeroelasticity analytical efforts will include coupling of the root pertubation method (RPM) computer code with an existing aeroelastic analysis. The strain gage data from the full-scale vacuum chamber tests will be used to evaluate the capability for extracting blade mode shapes. Major emphasis in this techincal area will be to implement plans to enhance the capability for predicting helicopter vibrations and the development of techniques for reducing these vibration levels. Control system logic will be designed for the TDT model and closed loop tests of a four-bladed system will be conducted. The program to develop a coupled rotor fuselage structural analysis will be continued. Evaluation of vibration reduction devices will concentrate on completing the state-of-the-art review and the generation of modular math models of vibration reduction devices.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Labs.

1.0022, AEROSOL LASER PASSIVE COUNTERMEASURES CONCEPTUAL DEVELOPMENT

K. Brentman, Boeing Co., Aerospace Division, *7555 E. Marginal Way S., Seattle, Washington* 98124 (DA0D4089; DAAJ02-77-C-0005)

Investigate aerosol/smoke systems compatible with the AH-1 helicopter that have the potential of providing laser designator/visual countermeasure capability.

Phase I will identify and document SOA with respect to aerosol/smoke formulations, dispensing systems and delivery systems responsive to mission requirements. Phase II will involve the conceptual development of candidate countermeasures systems.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0023, ELECTROMAGNETIC COUPLING ANALYSIS OF LEARJET AIRCRAFT

J.W. Schomer, Boeing Co., *7555 E. Marginal Way S., Seattle, Washington* 98124 (DF141290; F33615-77-C-2058)

The work supports the overall mission of increased safety of flight of advanced technology aircraft in adverse electromagnetic (EM) and all-weather environments. Induced electrical transients due to direct and nearby lightning strikes can cause system upset and damage to flight and mission critical avionics systems. The purpose of the work effort is to develop and apply EM coupling models in the form of computer codes to predict and interpret the time and frequency response of induced voltage and current

transients on selected cables and circuits within a NASA Learjet aircraft caused by lightning and EM field effects.

A NASA Learjet aircraft has been instrumented with electric and magnetic field sensors and current sensors to obtain in-flight data in thunderstorm environments at Kennedy Space Center during the months of Jul and Aug 77. Ground tests will also be run to obtain additional induced effects data. Test data will be compared with analytical predictions and results using developed computer codes. A final report will describe model development, computer codes, test and model verification results, data comparisons, and model modifications.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

ASTRONAUTICS

Includes Astronautics (general); Astrodynamics; Ground Support Systems and Facilities (space); Launch Vehicles and Space Vehicles; Space Transportation; Spacecraft Communications; Command and Tracking; Spacecraft Design, Testing, and Performance; Spacecraft Instrumentation; and Spacecraft Propulsion and Power. For Related Information See Also Aeronautics.

2.0001, STUDIES OF SOME BASIC PROBLEMS RELATED TO SATELLITE ANTENNA SYSTEMS

S.W. Lee, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Electrical Engin, *2527 Hydrosystems Lab., Urbana, Illinois* 61801 (DF049270; AFOSR-77-3375)

AF function - a major component of a communications satellite is its antenna. It has to meet stringent specifications in its beam position, gain, sidelobes, polarization and bandwidth. Deficiency - the two most commonly used satellite antennas are the reflector antenna and the wave-guide lens antenna. An incomplete procedure for their design prevents an accurate theoretical prediction of the antenna performance necessary for an optimal design. Objective - to eliminate some of the missing links in the design theory of satellite antennas. How work contributes - provide new methods applicable to design by solving related yet unsolved theoretical problems in electromagnetic theory.

1. Investigate the mutual coupling effects in a lens antenna, utilizing generalizations of infinite planar array diffraction and reflection analyses. 2. Explore novel and numerically efficient methods for calculating the secondary patterns of reflector and subreflector antennas.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

2.0002, RADIATION EFFECTS ON INSULATORS USED ON ARTIFICIAL EARTH SATELLITE

J.A. Wall, U.S. Dept. of Defense, Air Force, Rome Air Development Center, *Griffiss Air Force Base, Rome, New York* 13441 (DF903610)

The objective of this work is to provide fundamental information on the effects of electrons, with energies corresponding to those encountered in the orbital region of the satellites, on insulating materials used in communications satellites.

There are three electron-insulator interaction phenomena relating to electrical breakdown that will be investigated. These phenomena are induced conductivity, secondary electron emission, and injected charge distribution. Literature searches will be performed in each of these areas to determine the current availability of data and its relevance to the satellite charging problem. Where data is needed, experiments will be performed to obtain the required information. These experiments will consist basically of irradiating the insulating materials with electrons of appropriate energies in a clean, oil-free vacuum and measuring the induced conductivity and secondary electron emission. Injected charge distribution will be determined theoretically. The information generated by these investigations will be combined to select and test insulator-conductor combinations that will minimize the probability of space-radiation induced electrical breakdown.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, MECHANICS OF COMPOSITE MATERIALS

G.A. Hegemier, University of California, San Diego Campus, School of Engineering, Dept. of Applied Mechanics & Engin Sci, *P.O. Box 109, La Jolla, California* 92037 (DF044960; F49620-76-C-0024)

AF function - advanced aerospace vehicles require improvements in the thermal and environmental resistance materials and structures to meet mission objectives. Opportunity - three-dimensional carbon-carbon materials and advanced composites now being considered by the Air Force require material and structural characterization and environmental response predictions in order to reduce development uncertainties. Objective - the objective of this research is to develop a basic mechanics model of composite materials based on microconstituent properties in order to predict failure and damage under dynamic loadings and exposure to hygrothermal conditions. How work contributes - the major portion of this research is part of the joint AFOSR/ONR program to develop a basic understanding of carbon-carbon.

Research efforts will investigate the extension of existing theories to the following areas - (1) global and local stress and deformation fields in composites subjected to dynamic loading conditions, (2) failure modes and damage accumulation, (3) residual properties of damaged composites, (4) diffusion in composite materials, and (5) the conversion of constitutive relations to finite-element form. Methodology is based upon the mixture theory with microstructure concept. All global properties are determined from the composite geometry and the properties of the microcomponents. Such a theory allows a considerable improvement in modeling, guidance in material selection, and is an efficient and effective computational tool.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0002, NONEQUILIBRIUM PROPERTIES OF EXHAUST PLUMES

M.C. Branch, University of Colorado, Boulder Campus, Graduate School, *1200 University Ave., Boulder, Colorado* 80302 (DF045970; AFOSR-77-3103)

AF function - many future tactical rockets will require smokeless propellants. Deficiency - such propellants currently do not meet performance or stability requirements. Objective - this effort will measure the spatial and size concentrations of well-characterized laboratory jets. How work contributes - analytical models of low-signature low-altitude plumes will be compared with this data for modification of plume prediction codes.

Measurement techniques will be devised to obtain as accurately and as nonobtrusively as possible the characteristics of two-phase flows in a newly-built laboratory channel. Particle velocities, gas velocity, particle size and distribution, pressures, temperatures and molecular concentrations will be obtained. These data will be correlated to existing predictive codes for the flow.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0003, INTERACTION AMONG INHOMOGENEITIES 14127-E

T. Mura, Northwestern University, Evanston Campus, Technological Inst., Dept. of Civil Engin, *633 Clark St., Evanston, Illinois* 60201 (DA0E9287; DAAG29 77 G0042)

To study the elastic interactions among inhomogeneities under applied loads and to apply the results to constitutive equations and fracture mechanics. Improvements in fracture mechanics could provide results applicable to helicopter structure design. This method may provide a new approach to cracks under mixed modes and crack branching in composite materials.

A theoretical solution for two ellipsoidal inhomogeneities in an infinite medium under a linear applied stress at infinity will be the starting point. This will be generalized to the case where many ellipsoidal inhomogeneities are present.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0004, NMR STUDY OF VISCOELASTIC FLUIDS AND ELASTOMERS UNDER EXTREME CONDITIONS OF TEMPERATURE AND PRESSURE

J. Jonas, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Chemistry & Chemical Engin, *2527 Hydrosystems Lab., Urbana, Illinois* 61801 (DF046940; AFOSR-77-3185)

AF function - advanced aircraft systems employ viscoelastic fluids, elastomers and amorphous polymers as elastohydrodynamic lubricants, sealants, fuels and matrices which are subject to operation at high pressures and temperatures. Deficiency - the basic principles and parameters governing the behavior of viscoelastic fluids and materials, their dependence upon temperature and pressure and their correlations with molecular structure are not understood. Objective - using nuclear magnetic resonance relaxation techniques the dynamic structure of viscoelastic materials and fluids will be studies over wide ranges of temperature, pressure and viscosity. How work contributes - it is expected that this research will establish molecular structure-property relationships which can be utilized to predict and improve the life expectancy of viscoelastic fluids and materials for operational and future aircraft.

Systematic studies shall be conducted on - (1) the dynamic structure of fluorosilicone elastomers for integral fuel tank sealants, (2) investigating model systems to elucidate the effects of molecular structure on the dynamic behavior, shear viscosity, and glass transition, to test current theoretical models for the glass transition, and elucidate problems related to glass transition in amorphous polymers of current Air Force importance, and (3) NMR rotating coordinate frame characterization of very slow motional processes with measurement of self-diffusion and shear viscosities and the use of pressure to separate the effects of volume and temperature on molecular motions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0005, ARMOR APPLICATIONS OF TEXTURED METALS

A. Zarkades, U.S. Dept. of Defense, Army, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center, *Watertown, Massachusetts* 02172 (DA0B4807)

A continuing material requirement for properties optimization in high-strength steels is still needed. It is known that anisotropy resulting from texturing is not always exhibited in planar anistropy but can result in normal anistropy. Consequently texturing is important in material which is used in applications where the behavior is determined by material properties in the through thickness direction- e.g., armor plate, thus, the objective is to determine the effect of various processing history parameters and thermal schedules on texture development and control in armor-type steel. Major mission areas are aircraft and armored vehicles and their requirement for improved structural armor.

Electroslag remelted steels have become prime candidates for an increasing number of critical Army applications. Therefore, ESR 4340 steel will be rolled at various temperatures to include processing and thermomechanical working in the single and two-phase regions followed by quenching. The effect of percent deformation will also be considered. Microstructure and quantitative pole figure analyses will be accomplished. Mechanical properties will be determined for materials of interest.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center

3.0006, STUDY OF CORROSION SPECIES AND INHIBITORS ON ALUMINUM BY INELASTIC ELECTRON TUNNELING SPECTROSCOPY 14881-MS

H.W. White, University of Missouri, Columbia Campus, School of Arts & Sciences, Dept. of Physics, *130 Jesse Hall, Columbia, Missouri* 65201 (DA0F9101; DAAG29-77-G-0216)

To investigate the molecular species present at the microscopic interface between an aluminum surface and a reactive organic medium by inelastic electron tunneling spectroscopy (IETS). Relevance - the proposed research is relevant to degradation of aluminum and other metals in mobility equipment, firepower devices, aircraft structures, lightweight armor and other Army materiel.

Aluminum alloy tunnel junctions will be fabricated and characterized, including obtaining IETS spectra of surface films. Upon exposure to organic corrodants and inhibitors, the interfacial molecular species will be investigated (identity, nature of interaction). These data will be compared to electrochemical studies on the same alloys and on bulk alloys of the same nominal composition. The effect of orientation of adsorbed molecular species will be modelled to develop a theory which relates the IETS relative intensities to the orientation of adsorbed molecules.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0007, GREASE ANALYSIS

P.B. Senholzi, U.S. Dept. of Defense, Navy, Naval Air Engineering Center, *Lakehurst, New Jersey* 08733 (DN696007)

To determine the feasibility and effectiveness of 'grease analysis' as a diagnostic technique.

Develop a grease analysis technique and determine its diagnostic effectiveness through laboratory and field application.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

3.0008, MECHANICAL INTERFACE SPLINE DEVELOPMENT

P.B. Senholzi, U.S. Dept. of Defense, Navy, Naval Air Engineering Center, *Lakehurst, New Jersey* 08733 (DN896011)

To develop new design concepts for aircraft dry splines in order to reduce wear.

The approach in this effort will consider lubricants as well as contaminants, materials, surface characteristics, and design. Variations of these factors will be tested on pump splines. Test results shall define an optimal set of variables based on spline wear rate.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Material Command

3.0009, FAILURE PREDICTION IN GLASS 14889-MS

R.H. Doremus, Rensselaer Polytechnic Inst., School of Engineering, Dept. of Materials Engineering, *110 8th St., Troy, New York* 12181 (DA0F9271; DAAG29-78-G-0141)

To establish the functional dependence of failure time of glass upon externally applied stress. Relevance - the research is relevant to the static fatigue (failure of brittle materials which have been subjected to a constant load less than their modulus of rupture) of ceramics and glasses. Ceramics and glasses are subjected to conditions in service which could lead to fracture, e.g., ceramic radomes, ceramic armor, fiber optics, glass fibers in composites (helicopter rotor blades).

Measurement of delayed failure and failure at different loading rates (tau on the order of 0.01 2 to 1,000,000 sec) over a wide range of stress and derivation of equations for loading rate experiments from various relations between crack velocity and stress.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0010, OXIDATION OF NON-OXIDE CERAMICS

A.H. Heuer, Case Western Reserve University, School of Engineering, Dept. of Metallurgical & Materials Sci, *University Cir., Cleveland, Ohio* 44106 (DF051830; F49620-78-C-0053)

AF function - high-temperature ceramic turbine engines are being developed for the propulsion of Air Force remotely piloted vehicles (RPV). Deficiency - silicon carbide and silicon nitride type ceramics, formed by sintering or hot pressing powders, are

subject to high-temperature degradation in the extreme turbine operating environments. Creep, oxidation and microstructural changes within the ceramic need to be evaluated. Objective - the objective of this research is to study and understand the microchemistry and structural events which dictate the observable property changes in nonoxide ceramics. How work contributes -understanding the micro events will allow a rational approach to be taken in the selection of chemical composition and processing technique for improved materials.

Nonoxide ceramics such as silicon carbide and silicon nitride will be studied with a high-voltage transmission electron microscope (HVTEM). An environmental cell for in situ chemical reactions and stress applications will be utilized. The microstructure and distribution of phases will be correlated with microchemical analysis to elucidate the mechanisms of important chemical and physical property changes in these materials.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0011, MECHANISMS OF EROSION 14084-MS

N.H. MacMillan, Pennsylvania State University, University Park Campus, School of Earth & Mineral Science, Dept. of Materials Science, *116 Deike Bldg., University Park, Pennsylvania* 16802 (DA0F8961; DAAG29-78-G-0056)

To study erosion of materials by particles at subsonic velocities (less than approximately 3 x 10(4) cm/sec) in an attempt to identify the individual contributions of crack propagation and intersection, of plastic deformation, of impacting particle break-up, of particle-to-target adherence and of target melting to the overall erosion of a representative variety of metals and non-metals. The data would be used to make a first order estimate of the particular combinations of erosive environment and target characteristics leading to the onset and to the maximum detrimental effect of each identifiable mechanism of material removal. Relevance - the proposed research is relevant to a number of Army problems with particle erosion in helicopter rotor and turbine compressor blades and should represent a step forward toward understanding of erosion of missile components, gun tubes, and munitions.

He would investigate the surface and subsurface damage resulting when single-crystalline and polycrystalline solids of widely differing melting points and elastic-plastic response are impacted from different directions by particles varying in size, shape, and frangibility, and moving with different velocities.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0012, NAVY VEHICLE DESIGN AND CONSTRUCTION - ELONGATION AND ITS RELATIONSHIP TO RESIDUAL STRESSES IN BORON FILAMENTS

F.E. Wawner, University of Virginia, School of Engineering & Applied Science, Dept. of Materials Science, *Garrett Hall, Charlottesville, Virginia* 22903 (DN675404; N00014-76-C-0694)

Composite materials are seeing increased use on aircraft and other high-performance vehicles due to their specific weight and stiffness. This investigator will examine the phenomenon of elongation in boron filaments in an effort to enhance the boron production rate and thereby reduce the cost of this high-strength, high-stiffness reinforcement filament.

Boron filaments will be produced in a static reactor with controlled variables of temperature, gas composition, flow rate, substrate type and applied tension. Residual stresses present in the filaments, filament elongation, and filament mechanical properties will be measured. Results should indicate desired conditions for boron growth in a commercial continuous reactor. This will be explored in the later stages of the research.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0013, DEVELOPMENT OF IMPROVED HIGH STRENGTH ALUMINUM P/M PRODUCTS

K.J. Grundhoff, D F V L R, *Cologne, Federal Republic of Germany* (DF289500; AFOSR-77-3440)

AF function - research in improved and lower cost airframe components. Deficiency - present high-strength aluminum alloys suffer from stress corrosion and fatigue problems plus high cost of fabrication. Research - the objective of this technical effort is to determine the processing and metallurgical factors controlling the structure - fatigue behavior relationship in high-strength aluminum powder metallurgy products. The aim is to develop a processing schedule based on a desired microstructure that will yield improved combinations of fatigue behavior and acceptable other mechanical properties. A secondary objective is to determine the effect of hot isostatic pressing (HIP) to near net shape. How research contributes - if the true cost-saving potential of powder is to be realized, near net shape processes, such as HIP, and their effect on the improved combination of mechanical properties already demonstrated by Alcoa, namely fracture toughness, need to be investigated.

The program will develop a processing schedule based on a desired microstructure that will yield improved combinations of fatigue behavior and other mechanical properties. It will also examine the effect of HIP processes on resultant properties with the intention of optimizing properties and lowering component fabrication.

SUPPORTED BY U.S. Dept. of Defense, Air Force, European Office of Aerospace Research & Development

3.0014, EFFECTS OF HYDROSTATIC PRESSURE ON THE ELECTRONIC STATES OF IMPURITIES (1T161102BH57-07)

J. Mattler, Universite de Paris, Laboratoire de Luminescence, *Paris, France* (DA0D9419; DAERO 78 G0063)

The first part of the research under this proposal will be done on II-VI luminescent materials, specifically zinc sulfide and zinc selenide dopes with copper, manganese, iron or self-activated.

Will undertake a study of the effects of hydrostatic pressure on the electronic states of impurities. Initially the work will center on II-VII materials such as zinc sulfide and zinc selenide dopes with copper, manganese, iron or self activated. Later the work will study other materials. First will be complex molecular ions such as azides or nitrates in alkali halides or suitable compound semiconductors and the effects of hydrostatic pressure on their vibronic spectra. Secondly, deep level impurity states of III-V semiconductors such as chronium in gallium arsenide will be studies. Pressures of up to 100 kilobars are to be used to study the pressure-dependent effects.

SUPPORTED BY U.S. Dept. of Defense, Army, Army Materiel Development & Readiness Command

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, AN ANALYTICAL AND NUMERICAL STUDY OF SHOCK WAVE FORMATION

A.R. Seebass, University of Arizona, School of Engineering, Dept. of Aerospace & Mechanical Engineering, *Tucson, Arizona* 85721 (DN675087; N00014-76-C-0182)

The development of accurate methods to predict the transonic flow about complex configurations is essential for their design and optimization. The planned research will study time-dependent transonic flows and new concepts for the design of transonic airfoils and wings, and for the implementation of controllable-wall wind-tunnel ideas in three dimensions.

This research is an integrated numerical program to develop and exploit computational aerodynamics for the solution of transonic flow problems. The approach is inviscid; the governing equations will be either the small disturbance nonlinear equation or the full potential equation. Major emphasis will be on finite difference methods; however, finite element methods will be examined for the airfoil and wing optimization problem.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0002, FRACTURE OF ADHESIVE JOINTS AND ADVANCED COMPOSITES

W.G. Knauss, California Inst. of Technology, Graduate School, Dept. of Aeronautics, *1201 E. California Blvd., Pasadena, California* 91109 (DF047430; F49620-77-C-0051)

AF function - advanced aerospace flight vehicles require lighter weight and greater durability to meet future mission objectives. Deficiency - the Air Force currently lacks a full understanding of the failure process in adhesively bonded joints and advanced composites. Objective - objective of this research program is to experimentally elucidate fracture phenomena under long-term conditions of polymer-based structures. How work contributes - basic knowledge of fracture phenomena will significantly aid in the development of an accurate structural fracture criterion.

Experiments will be conducted to directly observe and measure fracture of polymer-based, adhesively bonded joints. Long-term exposure to mechanical stress and environmental conditions of high relative humidity and elevated temperature will be studied by these experiments. Also, fracture mode interactions will be studied at the intra-adhesive stress level.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0003, LOW SCAN ANGLE PERFORMANCE OF AIRBORNE FLUSH-MOUNTED COMMUNICATION ANTENNAS

V.P. Cable, California State University & Colleges, California State University, Northridge Campus, School of Engineering, Dept. of Engineering, *18111 Nordhoff St., Northridge, California* 91324 (DF052080; AFOSR-78-3624)

AF function - worldwide communication. Deficiency - good design techniques for antennae suitable for communication between supersonic aircraft and satellite are not available. Objective - design techniques for flush-mounted high-gain, wide-scan antennae. How work contributes -computer models for electronically steerable arrays including fuselage structure interaction will supplement experimental studies of size and placement.

The work proposed here will be a theoretical study of diffraction and mutual coupling effects in finite-sized flush-mounted scanning arrays and will lead to a model which predicts hemispherical scan coverage for a flush array mounted on an elliptic fuselage. The gain patterns for these antennas for near endfire scan (horizon) will receive major attention and applications of high-frequency (GTD) techniques will be used to study fuselage and array truncation effects on these patterns. The application of a hybrid moment method/GTD technique will also be considered in analyzing the mutual coupling and scan loss effects for the near endfire case.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0004, POWER CONDITIONER UNIT

L. Hodges, Delta Electronic Control Corp., *1701 Pomona Ave., Costa Mesa, California* 92627 (DN781392; N62269-76-C-0224)

To develop a power conditioner unit to provide the aircraft electrical requirements of 400 cycle and 28V DC power from the HVDC bus power. This contract supports work unit ZA601, Agency Accession No. DN681080.

To design the power conditioner unit utilizing advanced solid-state design techniques to provide with improved performance characteristics.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

4.0005, STABILITY, TRANSITION AND MIXING OF BOUNDARY LAYERS AND ADJACENT STREAMS

A. Demetriades, Ford Aerospace & Comm. Corp., Aeronutronic Division, *Ford Rd., Newport Beach, California* 92663 (DF040120; F44620-75-C-0016)

AF function - aerospace vehicles. Opportunity - defining and improving the performance of advanced weapons systems depends heavily on the increased understanding of the behavior of the flow fields influenced by the vehicle. Increased knowledge is needed on the transition to turbulence of the flow on systems such as reentry vehicles, heat shields and flowing gas lasers. Unexpected transition could adversely affect the ability to perform the mission. Objective -derive an analytic expression for the prediction of transition distance given in terms of the flow parameters for boundary layer, wakes and jets. How work contributes - provides design tools for the development of future aerospace systems.

Existing test data will be evaluated against the dissipation theory for transition. Equations for the prediction of transition for each type of flow will be formulated in terms of the time-averaged flow parameters. The theory for the transition for boundary layers will be extended to include the effects of favorable pressure gradient and surface roughness. Additionally, the theory will be applied to free shear layers of dissimilar velocities, total temperature and specie composition - but without initial boundary conditions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0006, SIMULTANEOUS SRS AND SHG IN LITHIUM IODATE

E.O. Amman, G T E Sylvania Inc., *Mountain View, California* (DF052450; F49620-78-C-0077)

AF function - this is an investigation in nonlinear optics concerned with the physical principles involved in the simultaneous generation of stimulated Raman scattering (SRS) and second harmonic generation (SHG). Such effects are important in doubling schemes used to generate new laser frequencies for AF applications. Opportunity - the need to have laser sources at additional wavelengths and to provide tunable sources for avionics applications increases the importance of having more fundamental knowledge of nonlinear optics. Objective -investigation of the interaction of two simultaneous nonlinear processes each of which occurs in the large-signal regime. Also, the improvement of optical frequency conversion efficiency. Contribution - a key feature of this proposed program is the development of a Raman/SHG device that will operate at kHz pulse repetition rates. The results of the research should lend insight into the physical behavior of two simultaneous nonlinear processes that might occur in a single crystal.

This research involves an investigation in nonlinear optics concerned with the physical principles involved in the simultaneous generation of stimulated Raman scattering (SRS) and second harmonic generation (SHG). The basic device that would be used in these studies is a Raman oscillator consisting of a lithium iodate crystal placed inside a 1.08 micrometer pumping ND-YAG laser. The first and second stokes outputs from this Raman oscillator occur at wavelengths of approximately 1.18 microns and 1.31 microns, respectively. But lithium iodate, the Raman medium, is also an established nonlinear optical medium. Thus one should be able to choose the lithium iodate crystal orientation such that phasematched SHG of the first or second Stokes lines will occur thereby producing visible outputs at about 0.59 microns or 0.65 microns, respectively.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0007, INVESTIGATION OF DATCOM PREDICTION METHODS

C.R. Bauer, McDonnell Douglas Corp., *3855 Lakewood Blvd., Long Beach, California* 90808 (DF139630; F33615-77-C-3034)

This work unit supports TPO 3, flight control, and specific goal FG02B, flight control system design techniques. A continuing effort is required to improve DATCOM coverage by refining existing methods and adding new techniques in concert with rapidly advancing technology. The objective of the recent effort is to conduct a comprehensive review of the DATCOM and related aerodynamic technology, both to uncover deficiencies and imbalances in current DATCOM coverage and to gain information for efficiently planning future exploratory development. Refined

design and analysis methods for use in the early stages of military aerospace vehicle design will substantially improve the quality and reduce the cost of stability and control evaluations.

The approach will consist of (1) a detailed, section-by-section review of the DATCOM to isolate errors and identify shortcomings and omissions in current coverage, (2) an investigation and evaluation of specific techniques for predicting the aerodynamics of missiles and the high-lift characteristics of close-coupled canards, and (3) the identification of other areas which appear to be amenable to solution at the present time, based on a survey of aerodynamic methods and data in the currently available literature.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0008, NONLINEAR FLUTTER

S.C. McIntosh, Nielsen Engineering & Research Inc., *850 Maude Ave., Mountain View, California* 94040 (DN890044; N00019-78-C-0118)

Investigate the influence of structural nonlinearities on the flutter of aerodynamic control surfaces.

A combined experimental/analytical study encompassing wind tunnel tests for simple aerodynamic sections with nonlinear torsional and plunging restraints together with theoretical predictions of limit cycle amplitudes and flutter speeds will be conducted. Correlations between calculated and measured results will be sought to identify the effectiveness and domains of applicability of the various analytical methods.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0009, STUDY OF TRANSONIC FLOW FIELDS ABOUT AIRCRAFT WITH APPLICATION TO EXTERNAL STORES

S.S. Stahara, Nielsen Engineering & Research Inc., *850 Maude Ave., Mountain View, California* 94040 (DF040660; F44620-75-C-0047)

AF function - advanced conventional weapons. Opportunity - improve analytical methods at transonic speeds for determining aerodynamic forces on stores. Objective - develop rapid computational method for calculating flow field around wing-body/pylon/store in transonic flow regime. How work contributes - development of an analytical method for computing flow fields will reduce the present requirement for extensive and expensive wind tunnel testing.

The program will be divided into three parts. In the first part a theoretical approach to compute the flow fields will be developed. In the second part a series of wind tunnel tests will be performed to gather the necessary baseline information. The third part will consist of checking computational method against experimental data and making refinements to the computational method as required.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0010, TRANSONIC WALL JETS

N. Malmuth, Rockwell International Corp., Science Center, *1049 Camios Dos Rios, Thousand Oaks, California* 91320 (DN675217; N00014-76-C-0350)

Increased emphasis on propulsive lift devices in advanced naval aircraft has stressed the need for an enhanced understanding of the underlying fluid dynamics processes which control the degree of force augmentation that can be achieved. The planned research will develop a methodology for predicting the flow field about an airfoil containing a transonic wall jet representative of a class of propulsive lift devices.

The interaction of the transonic wall jet with the surrounding flow will be computed for flow fields with increasing degrees of complexity. Initially a jet discharging into ambient air will be treated; viscous effects will be neglected both at the wall and at the outer slip line. Increasing complexity will be added in stages in the form of, first, an external flow and, subsequently, viscous mixing.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0011, THREE-DIMENSIONAL WALL JETS AND EFFECTS ON CORNER FLOWS

N. Malmuth, Rockwell International Corp., *1049 Camios Dos Rios, Thousand Oaks, California* 91320 (DN881482; N62269-77-C-0412)

To better understand the losses incurred and predict the resulting flow effects within thrust augmenting ejectors due to 3-dimensional work unit NN701, Agency Accession No. DN481077.

The approach to this program will be develop the mathematical formulation of the governing equations and boundary conditions to examine a wall jet in coflowing field finite cross flows and cross flow gradients. The relationships that apply some distance from the end walls will be solved numerically and parametric studies conducted to examine the effects of these finite cross flows on the evolution of velocity profiles, shear stress pressure distributions, sideslip angles and separation.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

4.0012, PARAMETER SENSITIVITY PROBLEMS IN FEEDBACK CONTROL SYSTEMS

N.K. Gupta, Systems Control Inc., *260 Sheridan Ave., Palo Alto, California* 94306 (DN775271; N00014-77-C-0247)

In many naval control problems, the control design must be insensitive to modelling errors. For example, for controlling aircraft landing on a carrier, the flow field generated by the carrier is not completely understood and so it is necessary for the aircraft to be insensitive to changes over possible flow fields. This is particularly true for automatically controlled carrier landings. This task will develop methodology for the design of simple control laws which are applicable to problems with such parameter uncertainties.

The contractor will develop methods for the design of optimal control laws which are insensitive to system parameter variations. The design methods will include pole and zero placement techniques, linear and nonlinear feedback on past states and inputs and periodic control.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0013, APPLICABILITY OF ELASTIC LAYER VERSUS WESTERGAARD ANALYSIS FOR AIRFIELD PAVEMENT

J.E. Crawford, U.S. Dept. of Defense, Navy, Civil Engineering Lab., Naval Construction Battalion Center, *Port Hueneme, California* 93043 (DN887004)

To establish guidance as to which technique, Westergaard or elastic layer, provides the analysis most appropriate to Navy-type airfield pavements.

Using data derived from rigid pavement sections tested at CEL during the last three years, the effectiveness of the Westergaard and elastic layer analyses for naval air stations will be assessed.

SUPPORTED BY U.S. Dept. of Defense, Civil Engineering Lab., Naval Construction Battalion Center

4.0014, ATMOSPHERIC FLUID DYNAMICS

F.H. Busse, University of California, Los Angeles Campus, Inst. of Geophysics & Planetary Physics, Dept. of Planetary & Space Science, *405 Hilgard Ave., Los Angeles, California* 90024 (ATM7622280A01)

The objective of the proposed research is to isolate and to elucidate basic mechanisms of atmospheric fluid dynamics. Both experimental and theoretical projects are planned. The interaction of laboratory measurements and mathematical analysis continues to be an important motivation for the proposed research. In addition, it is planned to investigate relationships of the research results with atmospheric observations. A major experimental and theoretical project is the study of Kelvin-Helmholtz type waves and their three-dimensional instabilities in an inclined layer of fluid heated from above. Another combination of experimental

and theoretical research is the investigation of spoke pattern convection, which represents the most common form of convection in the Rayleigh number range of 10 to the 5th power and 10 to the 7th power. Closely related to experiments carried out presently are the planned statistical study of convection in a rotating layer at low Rayleigh numbers and the proposed theoretical analysis of the observed cellular convection patterns at high Rayleigh numbers. Recent interesting results on finite-amplitude Ekman layer instabilities have motivated the proposal of a further detailed analysis of this project.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

4.0015, UNSTEADY FLOW OF AN OSCILLATING AIRFOIL IN TRANSLATIONAL MOTION 14741-E

C.M. Ho, University of Southern California, School of Engineering, Dept. of Aerospace Engineering, *3551 University Ave., Los Angeles, California* 90007 (DA0F9137; DAAG29-78-G-0023)

To investigate the unsteady velocity and pressure fields about an oscillating airfoil in translational motion normal to the freestream, in order to study the unsteady leading-edge separation and the unsteady kutta condition. Relevance - the description of the unsteady flow environment of a plunging airfoil is to direct relevance to understanding and predicting helicopter retreating blade stall and stall flutter, the delimiters of helicopter performance in forward motion.

The velocity and pressure fields of a heaving airfoil using novel measuring (hot-wire anemometry) and data processing techniques (mini-computer) will be determined for a range of Reynolds numbers and reduced frequency of oscillation. Details of leading-edge vortex bursting, subsequent viscous-inviscid flow interaction and unsteady flow about the sharp trailing edge will be quantitatively determined.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0016, AF THERMIONIC ENGINEERING AND RESEARCH PROGRAM

E. Shelton, Varian Associates Inc., *611 Hansen Way, Palo Alto, California* 94304 (DF742760; F30602-78-C-0213)

This program is to conduct theoretical and experimental research to revitalize and to sustain a technology base for microwave thermionic devices.

The instructional, theoretical, and analytical capabilities of a leading adacemic center will be brought into close union with a number of qualified industrial laboratories to assure optimum utilization of their combined resources. The university will initiate new concepts as well as infuse new advances from related technical disciplines. Industrial laboratories will provide the facilities for experiment and validation. Air Force function - earlier hoped-for solid-state solutions to requirements now prove deficient in power capability conversion efficiency and economic yield for many microwave requirements. The thermionic solution to needs require improved stability, conversion efficiency, and reduction of life cycle cost, attributes which remain realistic objectives provided that the essential underlying research receives support.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0017, SPACE APPLICATIONS OF S/C 276

C.A. Hamilton, U.S. Dept. of Commerce, National Bureau of Standards, *325 S. Broadway, Boulder, Colorado* 80302 (2764433)

Project objective: to study a broad range of superconducting microwave and infrared detectors which could be appropriate for the rigorous demands of space missions and to identify development needs.

Project approach: a broad literature survey will be made to determine fruitful areas for careful study. After a review of relevant material and direct contact with experts in the field, a report of projected capabilities and development needs will be made.

SUPPORTED BY U.S. Dept. of Commerce, National Bureau of Standards

4.0018, FEEDBACK SYSTEM THEORY

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AF function - the design of feedback systems for Air Force turbojet system control. Deficiency - the synthesis of linear feedback system with no parameter uncertainty is a straightforward task. However the synthesis of nonlinear feedback or linear single input-output multiple-loop systems with significant parameter uncertainties in order to satisfy quantitative performance specifications is inherently difficult and no effective procedures are available for these problems. Objective - the objective of this research program is to extend the synthesis theory for systems of the nonlinear feedback class to an infinite set of system inputs. The second objective is how best to divide the feedback burden between the loops of the linear single input-output multiple-loop system. How work contributes - success here would result in improved performance in major Air Force systems.

'Quantitative design' techniques will be extended to more complex multiple-loop structures than heretofore have been available. In the above, plant modification, i.e., feedback to internal plant variables, is not allowed, as the internal plant signal levels are then affected by the feedback. It is proposed to extend quantitative plant modification synthesis theory to more complex plant structures - to the general case of uncertainty in plant poles, zeros and gain factor - and to highly uncertain and intercoupled NXN multiple input-output plants.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0019, ROBUST PROCEDURES FOR COMMUNICATION DATA

P. PapantoniKazakos, University of Connecticut, Storrs Campus, Graduate School, *Storrs, Connecticut* 06268 (DF053490; AFOSR-78-3695)

AF function - radar signature recognition, remote sensing, image encoding, data compression, and performance monitoring of networks. Deficiency - improvements are needed in the techniques of signal estimation and image processing in the presence of unpredicted interference and abrupt changes. Objective - develop estimators that are 'robust' in the presence of statistically 'contaminated' communication data. How work contributes - this research will allow for better design of communication systems and signal processing techniques.

Solutions to the following problems will be attempted. (1) Robust estimates for mixtures and spectral parameters will be designed. (2) Robust smoothers for time series with stable performance qualities will be further studied. (3) Robust estimation and its relation to universal source coding will be studied. This allows for source encoding schemes to be studied with respect to their smoothness, and new encoding schemes characterized by such smoothness can be considered. (4) Robust network monitoring algorithms, which deals with the performance evaluation of network under possible substantial load fluctuations will be developed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0020, TARGET SURVEILLANCE, COMMAND CONTROL AND COMMUNICATIONS, FORECAST, PREDICTION OF SOLAR FLARES

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A capability is needed to forecast increases in solar short-wavelength radiation (solar flares) and in solar particle emission, since these produce ionospheric and geomagnetic disturbances which adversely affect radio communication, over the horizon radar, guidance-control, and detection.

Instrumentation is flown in rockets and satellites to determine the effects of flare activity on the sun's ultraviolet spectrum. Also, time-resolved images of flaring solar regions are recorded in their ultraviolet emission wavelengths to study the flare mechansim and to discover the causes of flares. New instruments for data

processing and for detection of extreme ultraviolet radiation are developed.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0021, RADIO INTERFEROMETRY

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Provide scientific data and investigate interferometer techniques leading to improved capabilities for application in areas of precise time, polar motion, astronomical constants and position reference systems, position determination, time transfer, navigation, geodesy and surveillance.

Conduct research leading to precision radio interferometer techniques with application to determination of UT, polar motion, and other earth rotation parameters, accurate position location on earth and in space, and time transfer over global distances. Map and investigate celestial radio sources by interferometer techniques. Determine improved astronomical position reference system using radio sources coupled with standard star systems. Evaluate source characteristics and environmental and instrumental limitations. Provide R&D support and technology transfer to USNO for operational applications.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0022, FAILURE PROCESSES IN ADVANCED COMPOSITE STRUCTURES

L.W. Rehfield, Georgia Inst. of Technology, School of Engineering, Dept. of Aerospace Engineering, *225 North Ave. N.W., Atlanta, Georgia* 30332 (DF052760; F49620-78-C-0085)

AF function - future high-performance aerospace vehicles will require improved structural efficiencies and increased durability. Deficiency - insufficient knowledge is available regarding the fracture of advanced composites and adhesive joints and their durability under environmental exposure. Objective - the objective of the research is to delineate the basic fracture behavior of advanced composites and adhesive joints and to understand the environmental degradation of their dynamic characteristics in both laminates and innovative structural configurations. How work contributes - research results will advance the state-of-the-art regarding the application of advanced composites to aircraft and missile primary structure.

Fracture processes of advanced composite laminates and adhesively bonded joints will be investigated using hybrid finite-element methods. Modeling of this process will be done at several levels, first, considering only the constrained matrix material, second, considering a unidirectional composite, i.e., matrix/fiber interaction, third, multidirectional laminates. Both mode I and mixed mode fracture will be studied. Degradation of advanced composite dynamic properties will be studied experimentally, based on elevated temperature and high-humidity environments. Reversible and irreversible changes in damping and stiffness characteristics will be investigated for a number of typical laminate geometries. Advanced composite isogrid panels will be tested in buckling to study the failure mechanisms of this innovative structural concept.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0023, STUDIES OF DYNAMIC STALL OF AIRFOILS FOR HELICOPTER ROTORS 12742-E

A.A. Fejer, Illinois Inst. of Technology, School of Engineering & Physical Science, Dept. of Mechanical Engineering, *3300 S. Federal St., Chicago, Illinois* 60616 (DA0H5577; DAHC04-75-G-0142)

To study the quantitative description of the dynamic stall process for various values of advance ration, reduced frequency, mean value and amplitude of the angle of attack, and the Reynolds number on an oscillating airfoil in a periodically varying freestream. Relevance -this research is directly relevant to the dynamic stall studies in progress at the Ames and Langley Directorates of the AMRDL. In addition, experimental techniques developed in this proposal are also relevant to activities at the Ames Directorate of AMRDL.

The study will make use of two special IIT experimental facilities (a water tunnel and wind tunnel) that enable one to simulate concurrently the oscillations in angle of attack and in freestream velocity to which rotor blades are subjected.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0024, UNSTEADY AERODYNAMIC FORCES ON CAMBERED AIRFOILS AND OSCILLATING CASCADES

H. Atassi, University of Notre Dame, School of Engineering, Dept. of Aerospace & Mechanical Engineering, *Notre Dame, Indiana* 46556 (DF038600; AFOSR-74-2675)

AF function - advanced turbomachinery. Opportunity - improve ability to predict aerodynamic forces on compressor blades. Objective -determine unsteady aerodynamic forces, moments, and pressure distribution on compressor blades oscillating or subject to gust disturbances in a subsonic flow as a function of flow parameters. How work contributes - will provide method to more accurately calculate flutter conditions in turbomachinery.

A theory has been formulated for calculating the unsteady forces, moments and pressure distribution on an airfoil which accounts for shape and mean incidence. Extension of the theory to the case of a cascade oscillating about their mean position with interblade phase angle is underway. Upon completion of this extension, the case of a cascade in a periodic gust will be attempted.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0025, MULTISTAGE AXIAL-FLOW TURBOMACHINE WAKE PRODUCTION, TRANSPORT AND INTERACTION

T.H. Okiishi, Iowa State University of Science & Technology, School of Engineering, Dept. of Mechanical Engineering, *496 Town Engineering Bldg., Ames, Iowa* 50011 (DF042140; AFOSR-76-2916)

AF function - advanced turbomachinery. Opportunity - improve understanding of flow through an axial flow turbojet engine. Objective -obtain a better understanding of the fluid flow physics related to multistage, axial flow turbomachinery. How work contributes - a better understanding of the fluid flow will improve our ability to produce competent turbomachine configuration designs.

The effort is primarily an experimental study using a low Mach number, three-stage axial flow research compressor. Detailed flow field data will be obtained and analyzed. The research results will then be incorporated into turbomachine design procedures.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0026, BALLISTICS TECHNOLOGY-FLIGHT DYNAMICS--EXPLORATORY DEVELOPMENT TESTING--AERODYNAMICS

R.H. Krieger, U.S. Dept. of Defense, Army, Armament Research & Development Command, Ballistic Research Lab., *Aberdeen Proving Ground, Maryland* 21005 (DA0N4426)

This project covers exploratory development tests and applied research programs in the field of aerodynamics and flight mechanics which contribute to the rational design of projectiles, missiles, shells, and rockets. Significant studies undertaken involve the measurement of supersonic and transonic magnus force on nonconical boattails--determine supersonic magnus force on low-drag ogive boattail models--probing the transonic boundary layers--obtain total head pressure surveys of the boundary layer on yawed spinning models with boattails--and to perform 3D transonic inviscid flow calculations.

Exploratory development tests and applied research programs are conducted in closed circuit variable density, continuous flow transonic and supersonic wind tunnels as well as in free flight ranges. Theoretical analysis and numerical techniques are also used.

SUPPORTED BY U.S. Dept. of Defense, Armament Research & Development Command, Ballistic Research Lab.

4.0027, RESEARCH IN BALLISTICS-FLIGHT DYNAMICS--RESEARCH IN AERODYNAMICS-MAGNUS COMPUTATIONAL MODEL-NOSE BLUNTNESS

R.H. Krieger, U.S. Dept. of Defense, Army, Armament Research & Development Command, Ballistic Research Lab., *Aberdeen Proving Ground, Maryland* 21005 (DA0P4438)

To develop and to refine computer codes for calculating magnus effects for spinning projectiles in supersonic flight.

This project is a continuing effort to refine the computation capability now developed and to establish the validity of the computed results by comparisons with available experimental data. Computations are to be run for m equal 2, 3, and 4 at angles of attack up to 10 degrees. The projectile shapes to be considered will include changes in longitudinal curvature and boattail afterbodies.

SUPPORTED BY U.S. Dept. of Defense, Armament Research & Development Command, Ballistic Research Lab.

4.0028, DEVELOPMENT OF CAST CARCASS TIRES FOR MILITARY AIRCRAFT

E.J. Georgia, Zedron Inc., *Baltimore, Maryland* (DF132480; F33615-76-C-3062)

This effort supports the development of tires for Air Force aircraft. Tires are presently fabricated from a multiplicity of components assembled by essentially manual operation, which results in high tire cost. The carcass of this tire will be cast in one piece from polymer materials and the tread belt will be of conventional cord and rubber construction. A significant reduction of tire cost will be made possible by the reduction of labor and equipment needed to fabricate a cast carcass, rather than conventional cord and rubber carcass.

This effort consists of the development and evaluation of three different cast tire design concepts - a one-piece cast tire, a two-piece cast carcass replaceable rubber and cord material tread, and a cast carcass with an integral rubber and cord material tread. The developmental tires to be fabricated under this effort will be the A-37 aircraft 7.00-8/16 PR type III size. Three phases of work will be accomplished. First, an evaluation will be done to establish optimum materials and fabrication methods. Then, tire developmental iterations will be conducted to determine and optimize the most promising design concept. Each iteration will consist of tire design, fabrication, laboratory test and evaluation. In the last phase, thirty tires of the best design will be delivered for extensive testing by the Air Force.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0029, ENVIRONMENTAL AERODYNAMICS WITH APPLICATION TO WIND ENGINEERING FOR URBAN STRUCTURES

L. Morino, Boston University, School of Engineering, Dept. of Aerospace Mechanical Engineering, *755 Commonwealth Ave., Boston, Massachusetts* 02215 (ENG7817620)

The primary objective of this research project is to develop a theoretical formulation which will explain the complex mechanism of building aerodynamics.

This objective is approached by solving the Navier-Stokes equations for velocity and pressure distributions, using a new numerical method which requires less computer time than the finite-difference solution. Compressibility effects are neglected, and vorticity dynamics are analyzed by concentrating the vorticity into discrete vortices. The theoretical formulation is quite general, and can be applied to viscous flows around bodies having arbitrary shapes.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0030, NEW LASERS BASED ON COMPLEXES OF TRANSITION METALS

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AF function - this program is concerned with the development of an entirely new class of visible lasers which should represent a significant advance in coherent light sources. In Air Force applications, the ability to rapidly tune the wavelength of short, high-energy pulses would be a distinct advantage in many countermeasures, ranging and guidance applications. Deficiency - for these kind of avionics applications, ordinary dye lasers often fall short of the required energy per pulse and average power. Objective - the objective of this work is to develop materials and technology which will result in tunable systems having many of the advantages and properties of dye lasers but which would have superior energy storage capability, offer the possibility of q-switching, and which could be pumped with much higher energy light sources without the extremely short flash duration requirement of dyes. Contribution - some of the complexes of transition metals emit light with lifetimes, line width and extinction coefficients which are intermediate between the dyes and the rare-earth liquid lasers. These complexes bring a new dimension to optically pumped lasers whether solid or liquid.

The single property which is most significant for the operation of dye lasers is the short radiative lifetime (in the nanosecond regime) of the fluorescence process. It is this short lifetime which is responsible for the high gain but which at the same time represents a limitation where energy storage is important. The key problem is to find materials with longer radiative lifetimes, but line widths and yields comparable to dyes. Materials exhibiting strong phosphorescence are of limited interest due to the combined effect of broad line width and long lifetime on the laser threshold. The complexes of transition metals offer an alternative which is the thrust of this research. Representative compounds from every class of luminescent complexes which show promise as laser materials have been synthesized. The ruthenium (II) complexes are the most promising laser materials. Emphasis will now be placed on laser experiments using a high-energy flash lamp. The emission lifetimes of the complexes are longer at low temperature, and initial experiments will be done at 77 degrees K. Characterization will include selection of systems most likely to lase near room temperature. (Text abridged.)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0031, TURBULENT BOUNDARY LAYER STRUCTURE AND DRAG REDUCTION

M.T. Landahl, Massachusetts Inst. of Technology, School of Engineering, Dept. of Aeronautics & Astronautics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DF039310; AFOSR-74-2730)

AF function - aerospace vehicles, propulsion and power. Opportunity - in the design of turbine engines, air intakes, combustion chambers, lifting surfaces, and aerodynamic shapes which require information on heat transfer, drag, and pressure fluctuation, it is necessary to predict and understand the structure of turbulent fluid flow. Unfortunately, turbulence remains one of the more vexing problems in fluid dynamics and its technical applications. This research proposes to further develop and explore the consequences of a new dynamical model of the fluctuating velocity field in a turbulent boundary layer first proposed by Professor Landahl. If successful, the model should be a major contribution in predicting and unravelling the mechanics of turbulent flow. Objective - to further develop a new dynamical model of the fluctuating velocity field in a turbulent boundary layer using as the cornerstone of the model a wave theory for secondary breakdown of a laminar flow developed by Landahl. How work contributes - statistical theories of turbulence have not been able to explain turbulent transport and other observed phenomena. Observations indicate that there may be a more ordered structure underlying turbulent than implied in statistical approaches. One of the more promising developments in modeling turbulence has been the recent model of wave breakdown offered by Landahl. It is proposed to use this wave theory of secondary breakdown as a cornerstone for a new dynamical theory of turbu-

lence. If successful, the new theory should also help explain drag reduction by additives, compliant walls, etc., and point the way to the control of turbulence.

Theoretical - kinematic wave theory is used to identify conditions of criticality under which waves of small scale focus on larger scale non-homogeneities and grow rapidly to very large amplitudes leading to observed turbulent structure and character. This wave theory includes nonlinearity, dispersion and the possibility of discontinuities in the flow. Spectral characteristics of the large-scale fluctuating velocity field are obtained by direct numerical integration of an inhomogeneous Orr-Somerfeld equation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0032, EXPERIMENTAL STUDIES OF FLIGHT PERFORMANCE OF GLIDING PARACHUTES

W. Nykvist, U.S. Dept. of Defense, Army, Natick Research & Development Command, *Natick, Massachusetts* 01760 (DA0H4257)

To obtain in-flight aerodynamic performance data to confirm/refine key parameters used in six-degree-of-freedom (6-DOF) computer simulation. To procure and test selected guidance and control systems used to guide a cargo-carrying gliding parachute to a specific landing area.

Design and fabricate a gliding parachute flight data recording system using existing ASN-95 transmitter and receiver. Continuously record up to 14 variables while guiding the parachute through specific maneuvers. Use data to adjust and refine assumptions used in 6-DOF computer program. Use testing experience and computer simulation to choose specific guidance and control system for procurement and test prior to engineering development.

SUPPORTED BY U.S. Dept. of Defense, Army, Natick Research & Development Command

4.0033, FUNDAMENTAL RESEARCH IN TURBULENT MODELING

C. Donaldson, Aeronautical Research Associates of Princeton Inc., *50 Washington Rd., Princeton, New Jersey* 08540 (DF042850; F44620-76-C-0048)

AF function - advanced aerospace vehicles. Deficiency - lack of understanding about turbulence and turbulent flows. Objective - modeling of turbulent flows with particular emphasis placed on terms dependent on pressure fluctuation. How contributes - an understanding of pressure fluctuations and their effect on turbulent flows is very important in understanding high-speed flows. It also implies an understanding of noise radiated by turbulent flows. Understanding of this phenomenon will be directly applicable to the design of advanced aerospace vehicles.

A theoretical program reevaluating the modeling of turbulent flows will continue. Primary emphasis will be the development of rational scale equations and their application to correlation models containing the pressure fluctuations p'. Secondary emphasis will be on the modeling of triple scalar correlations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0034, A THREE-DIMENSIONAL STUDY OF FIN-INDUCED SHOCK WAVE TURBULENT BOUNDARY LAYER INTERACTIONS 14026-E

I.E. Vas, Princeton University, School of Engineering & Applied Sciences, Dept. of Aerospace & Mechanical Engineering, *Box 430, Princeton, New Jersey* 08540 (DA0E9174; DAAG29-78-G-0140)

To more thoroughly investigate the scale of the ineraction between a shock wave from a sharp leading edge generator and a turbulent boundary layer on a flat plate by changing the boundary layer thickness using unswept and swept leading-edge flat plates. The research is relevant to activities at BRL and other Army laboratories concerned with designing fin-stabilized anti-tank projectiles and fin-stabilized long-range missiles.

An experimental study will be conducted in the Mach 3 high Reynolds number supersonic facility of the contractor by examining lscale effects of the boundary layer in the interaction region and measuring heat transfer for a thin boundary layer configuration.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0035, DIGITAL/MODULAR AVIONICS

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The objective of this task is to design and breadboard a core Army avionic system using digital integration techniques. This type of system will provide the Army pilot with a capability which will simplify his workload by giving him a central control panel, and a general-purpose display. In addition, it will provide the flexibility to add or delete from the aircraft configuration with redesign or modification of the basic aircraft installation.

A basic set of Army avionics equipment, including communications, navigation, and identification subsystems, will be selected for bench integration over a digital data bus system. A single keyboard-type control box will be developed to control all subsystems, and a general-purpose display will also be developed. Following the bench test phase, the equipment will be installed on a test-bed aircraft for flight tests.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Avionics Research & Development Activity

4.0036, TRESTLE WIND STUDY

G. Ludwig, Calspan Corp., *1422 Genesses Ave., P.O. Box 235, Buffalo, New York* 14221 (DF190090; F29601-77-C-0093)

The purpose of this work is to identify and study by means of a wind tunnel analysis unique wind flow characteristics at the trestle EMP facility and the implications of these flows upon safe aircraft testing procedures.

A wind tunnel study of wind flow utilizing a detailed model of the trestle will provide data for a detailed flow analysis to determine the effects of the terrain and the facility on the general flow pattern and to identify those flow patterns that might yield high-risk test situations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Weapons Lab.

4.0037, REAL GAS DIAGNOSTICS AND SIMILITUDE

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Deficiencies exist in the present-day technology concerning instrumentation systems and ground simulation facilities, especially for the adverse conditions encountered during re-entry. The objective is to overcome such difficulties by obtaining quantitatively and in real time the spatial and temperal thermochemical properties which characterize the flow fields in the ground tests. Thus, the reduction of weapon system development costs can be realized by minimizing the number of expensive free flight tests.

More reliable and precise data base can be established by developing the electron beam fluorescence, emission and/or absorption spectroscopy, laser Raman scattering and their associated mechanical, electro-optical detection and data acquisition systems to cover different regimes of the flight profile of military weapon systems as required to fulfill DOD missions. Work units 14260106, 14260123, 14260125, 14260129, 14260130, 14260132, 14260139 and 19290414 are in process of termination and the remaining work of these will be consolidated under this new work unit.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0038, SURVEILLANCE - OPTICAL COMMUNICATION AND METAL SCREENING

L. Felsen, Polytechnic Inst. of New York, Brooklyn Campus, Graduate School, Dept. of Aerospace Engin & Applied Mech, *333 Jay St., Brooklyn, New York* 11201 (DN475357; N00014-76-C-0144)

The loss of information from optical sources at high altitudes as a result of propagation through a turbulent atmosphere as well as means for compensating or correcting for the image distortion of an object is of considerable importance to the Navy and DARPA for development of advanced surveillance equipment.

Various methods will be investigated for correcting image degradation due to atmospheric turbulence, diffraction, and photon noise with emphasis on dynamic compensation techniques and short exposure reception. The investigation will include: design of an adaptive compensator, determination of relevant turbulence statistics during reception, optimum methods for approximate phase compensation, statistical properties of speckle and deconvolution in the presence of noise. In addition the loss of information from an optical source at high altitudes as a result of propagation through a turbulent atmosphere which is described by a non-Karman modified Kolmogorov correlation spectrum will be studied.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0039, LIFE CYCLE COST STUDY

J. Klion, U.S. Dept. of Defense, Air Force, Rome Air Development Center, *Griffiss Air Force Base, Rome, New York* 13441 (DF736880)

To investigate means through which the life cycle costs of Air Force electronic equipments and systems can be evaluated, optimized and predicted.

Continual survey and analysis of appropriate models, documentation, policies with regard to life cycle cost in general. Efforts relative to the development of level of repair synthesis (determining the LRU complement, mix, complexity level, size, cost with attendant reliability and maintainability characteristics) which will optimize life cycle cost. Determination of the impact of reliability, maintainability and test equipment on acquisition and support/logistics costs. Determination of cost differences in hardware as a function of level of repair and performance characteristics. Studies and analyses of warranty effects.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0040, LASER PELLET PLASMAS FOR THE DEMONSTRATION OF X-RAY LASER ACTION

M.J. Lubin, University of Rochester, School of Engineering & Applied Science, Dept. of Aerospace & Mech Science, *260 Crittenden Blvd., Rochester, New York* 14627 (DF026400; AFOSR-77-3189)

AF function - operation of high-altitude vehicles in a post-nuclear explosion environment, development of electromagnetic weapons, space and ionospheric communications as well as countermeasures demand fundamental understanding of energy transformation processes occurring in plasmas such as X-ray lasing media. Deficiency - the aforementioned information required to design advanced equipment is not available today. Its acquisition may be realized by a well-planned theoretical and experimental research. Objective - this project will investigate both theoretically and experimentally the fundamental characteristics of energy transformation processes. It will specificially study various X-ray lasing media, namely, concentrate on 3P-3S transitions in carbon-like ionization states of elements in the vicinity of argon, in the periodic table. Contribution - this work is a part of a comprehensive program of plasma research for the development of an X-ray radiation source for simulation of nuclear weapon effects, the development of advanced electromagnetic weapons (laser and particle beam) the development of space and ionospheric communications and the development of countermeasures.

This project will perform theoretical and experimental work to understand the energy transformations processes occurring in X-ray lasing media. They will perform experiments to demonstrate gain on 3P-3S transitions in carbon-like ions excited in a laser-produced plasma. Single laser pulses of 10 joules will be focussed by a cylindrical lens onto a solid target surface of a suitable material. The preliminary studies will be on plasmas formed from targets composed of elements in the vicinity of argon on the periodic table, e.g., LiCl, KCl, CaC12, CaSo4. They will measure the angular distribution of the emission line spectrum from the plasma. They will employ two vacuum ultraviolet grating spectrographs. Again the pulse width of these experiments corresponds to the one found from the numerical modeling. Experiments will be performed in the new facility which has ample power to obtain reliable and reproducible data for single shot experiments.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0041, GAS CORRELATION FOR CARBON MONOXIDE

W.F. Herget, U.S. Environmental Protection Agency, *Research Triangle Park, North Carolina* 27709 (DF336440)

To evaluate the capability of gas correlation spectroscopy for the remote (non-contact) sensing of carbon monoxide. Presently available point monitoring sensors have proven unreliable or inappropriate for determining the contribution of airfield operations to local environmental quality. A remote system would provide an integrated pollutant load.

Joint funding with EPA. Two existing systems will be evaluated by an independent party to determine their sensitivity, specificity, accuracy and reliability, and to recommend improvements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Civil & Environmental Engineering Development Office

4.0042, TRANSIENTS IN TURBOCOMPRESSORS

W.C. Griffith, University of North Carolina, North Carolina State University, School of Engineering, Dept. of Mechanical Engineering, *Raleigh, North Carolina* 27607 (DF043290; F44620-76-C-0055)

AF function - advanced turbomachinery. Opportunity - provide analytical techniques for coping with rotating stall. Objective - study experimentally and analytically the unsteady response of a single turbocompressor stage to inlet distortion with emphasis on the phenomena of surge and rotating stall. How contributes - development of flow model to predict rotating stall analytically will allow engine designers to more accurately predict engine performance without need for extensive ground testing.

Experiments will be performed in a large-scale rotating rig with appropriate inlet distortion screens. Steady-state pressure measurements will be made in the inlet, in the blade row and downstream of the blade row. A flow model will be developed and its predictive capability determined.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0043, INFLUENCE OF STOICHIOMETRY ON THE IMPINGEMENT EROSION OF LEAD SULFIDE AND ZINC SULFIDE

R.G. Hoagland, Battelle Memorial Inst., Columbus Laboratories, *505 King Ave., Columbus, Ohio* 43201 (DF048220; AFOSR-77-3283)

AF function - aircraft and missile operations are highly dependent on electromagnetic windows necessary for the transmission and reception of signals for navigation, target acquisition, target designation and communications. Deficiency - the vehicles must perform at high velocity in adverse weather where rain erosion of the exposed window is a serious problem. Objective - the objective of this work unit is to study the influence of stoichiometry on the rain erosion of ceramic windows. How work contributes - decreasing the surface erosion on windows will significantly improve the accuracy, sensitivity, and detectability of the electro-optical systems.

The approach is to investigate in detail the specific mechanisms of surface layer deformation produced by high-velocity liquid droplets for several binary alloys whose mechanical properties can be systematically varied through control of

compound stoichiometry. Materials to be studied include PbS, ZnSe, and ZnS. Liquid drops of silicone oils and mercury will impact the samples at a relative speed up to 680 m/sec (Mach 2).

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0044, ESM PROCESSING TECHNIQUES EVALUATION
J. Caschera, U.S. Dept. of Defense, Air Force, Avionics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF097980)

The objective of this effort is to test and evaluate the performance of digital equipment used for passive ECM. This includes receiver to processor interfaces, data processing computers, both general and special purpose (preprocessors) and processor to user interfaces such as power management, displays, etc. This also includes interfacing passive ECM equipment with the digital avionics information system (DAIS). Current tasks under this work unit are (a) fabrication of the high probability intercept receiver (HPIR) to microcomputer array processor (MAP) interface, (b) interfacing the adaptive electronic support measures (AESM) system with DAIS and (c) the design, fabrication and testing of a large-capacity ECM digital data recorder/reproducer.

Where possible digital processors will be interfaced with receivers and other components of the ECM system and tested with simulators such as the dynamic electromagnetic environment simulator (DEES). Where not possible, the input to the processor will be simulated by means of digital word generators simulating the output of the receiver operating in a static emitter environment. It is also possible to record the digital output of the receiver separately on magnetic tape or disc and playing the data back in real time to the processor at a more convenient time and place.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Avionics Lab.

4.0045, HIGH ALTITUDE MULTI-MISSION
S.L. Brown, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF140860)

Developments in high-energy laser (HEL) technology have created new opportunities for long-range, high-altitude strategic defense missions. The HEL weapon must be integrated into a platform, nominally an aircraft with performance characteristics tailored to these new mission requirements. The aircraft to perform these missions will require new design concepts incorporating technology advances in aerodynamics, structures, flight controls, and vehicle equipment. The Air Force Weapons Lab (AFWL) is sponsoring application studies for these missions, including a contracted study with Boeing to examine the use of a 747 aircraft as the weapon platform. To enhance the understanding of aircraft influence on the mission, AFWL has requested the AFFDL conduct a conceptual design study of vehicles optimized for this application. By conducting this design effort, AFFDL will identify those flight vehicle technologies with the most influence on this type of aircraft. This identification will lead to a timely development and availability for application in the event the AF makes a commitment to proceed with this mission. In addition, the technologies identified here can have application to other AF missions, such as strategic airlift, reconnaissance, and missile carrier.

A conceptual design study has been formulated with the objective of creating new advanced technology flight vehicle concepts. The AFWL will specify mission profiles, performance requirements, and HEL weapon characteristics. The AFFDL tasks include configuration options, aircraft sizing, parametric analysis, and aircraft comparison. There will be four vehicles and two types of lasers, to illustrate the range of design options. Aircraft sizing will require the use of computer-aided design tools to determine aircraft parameters for the given missions. Parametric analysis will examine the major elements which influence the design. The design from this in-house activity will be compared with the retrofit designs proposed by Boeing in the contracted HAMM study. This comparison should illustrate the magnitude of the potential benefit of new designs with advanced technology.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0046, ADVANCED AERODYNAMICS, HIGH LIFT AND MANEUVER AUGMENTATION
S.C. Stumpfl, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF141760)

Advanced tactical aircraft currently under study are being driven toward much higher wing loading to permit supersonic penetration of highly sophisticated defenses. Aircraft designed to these requirements can be at a disadvantage for an off design mission or in an air combat situation. The objective of this effort is to identify and evaluate promising aerodynamic technologies for improving the mission performance of a variety of Air Force aircraft but with emphasis on increasing the maneuver capability of high wing loading aircraft through favorable airframe - propulsion system interaction, i.e., powered lift.

Individual investigative effort will proceed from literature search through analysis and payoff assessment of experimental validation and prediction methods development. Contracted efforts will be used to augment and complement this in-house work unit as required. Manuever augmentation through application of powered lift is to be investigated in the AFFDL trisonic wind tunnel (TGF) with a half-span, vectored-engine-over-wing model. Results will be correlated with large-scale, full-span results of the same powered lift concepts acquired under contract work unit 14760316. This serves to validate the TGF half-span test facility after which additional parametric variations may be tested at low cost to expand the data base for design purposes. A 1/15 scale unpowered, flowthrough configuration model of an advanced propulsive lift concept will be designed and fabricated for testing at AEDC and NASA test facilities. The test results will provide baseline data for powered-lift and high angle of attack aerodynamics investigations. High-altitude, long-endurance aircraft improvements will be sought through advanced airfoil design. Investigation will be conducted to develop methods for advanced airfoil design.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0047, AUTOMATED STRUCTURAL ANALYSIS AND OPTIMIZATION
V.B. Venkayya, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF134020)

The severe demands on the strength requirements of the modern aerospace vehicles require optimization procedures to reduce the growing weight of these vehicles. The general objective of this effort is to develop necessary tools for integrated design of advanced aerospace structures. The specific objective is to develop methods and build capability for minimum weight design of structures with strength and stiffness requirements under subsonic and supersonic flight conditions and impulse loads such as aerodynamic gust and impact due to aircraft landing. Economy, reliability, and reduced design time are the major benefits expected from this effort.

Under the two completed work units (JON 14670111 and 14670112) optimality criteria methods were developed for minimum weight design of structures. These methods will be further developed for use in practical design conditions. Mathematical programming methods will be coupled with optimality criteria methods to handle complex design situations. These methods will be coded into computer programs to achieve the design objectives.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0048, ENGINEERING AND ANALYSIS SUPPORT OF SIMULATION STUDIES
A.A. Gillis, University of Dayton, Research Inst., *300 College Park Ave., Dayton, Ohio* 45469 (DF318330; F33615-77-C-0520)

To perform in-depth analyses on data collected in previous remotely piloted vehicle system simulation studies in order to arrive at a system configuration for which optimum performance can be expected.

Performance measures with certain desirable properties will be selected. These measures will be subjected to analytical methods which will give an indication at which points (or values)

the system should be operated so as to optimize the performance of the total system. These analyses are over and above those done previously on the data.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

4.0049, TIME-DEPENDENT JET FLOWS

H. Viets, Wright State University, Graduate School, *Dayton, Ohio* 45431 (DF137520; AFOSR-78-3525)

This effort supports development to airborne pointing and tracking systems and advanced laser aerodynamics applications. Specifically, improved understanding of time-dependent shear flows will aid in the design of open ports for airborne applications. The present program will attack the problem of the structure of time-dependent jet flows and examine these flows in relation to the state of the art in the study of large-scale steady turbulent jets. The data generated will contribute to the effectiveness of future combat aircraft containing radiation subsystems for projection and detection in passive and active roles.

Design and construct several time-dependent nozzles, probably the acoustic feedback type. Probe the nozzle flow in detail with a hot wire anemometer. Supplement these measurements with water table flow visualization and an analytical effort of modest scale.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0050, PROCESSING OF ADVANCED ELECTROMAGNETIC WINDOWS - CHEMICALLY VAPOR DEPOSITED SILICON NITRIDE

R.A. Tanzilli, General Electric Co., Reentry & Environmental Systems Division, *3198 Chestnut St., Philadelphia, Pennsylvania* 19101 (DN675314; N00014-78-C-0107)

Future tactical missiles will need improved IR domes or radomes. Dual mode capabilities may also be desirable. Presently used materials are not suitable for such uses because severe operating conditions would be imposed upon them at levels beyond their useful capabilities. Improved materials must possess useful mechanical thermal, optical electrical and chemical properties and must also be fabricable. This task is aimed at materials processing, characterization and property determinations. The results will be used to evaluate the suitability of chemically vapor deposited silicon nitride as an advanced dome material.

Work will continue along several directions. Deposition condition optimization is being studied for forming smooth flat plate materials thicker than 5 mm at rates of 1 mm per hour; strength optimization via grain size control will be done by gas phase changes. The origins and control of absorption and scattering will be investigated for anisotropic crystalline alpha - Si3N4 and for isotropic amorphous CVD Si3N4. Key physical properties being evaluated include mechanical, thermal, optical, electrical and microstructural parameters.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0051, STUDY TO DETERMINE THE VALIDITY OF BIOLOGICAL BOMB DETECTION

Unknown, U.S. Veterans Admin., Dept. of Medicine & Surgery, Medical Center, *38th & Woodland Aves., Philadelphia, Pennsylvania* 19104 (FA78WAI-854; FA161221 (TRAIS NO.))

The objectives of this program are to determine sustained performance characteristics of gerbils and domestic rats in olfactory discrimination; the best training method to develop the animals for placement in an explosive detection system; and the effective repertoire of odors that these animals can be trained to detect. The design of this research should be consistent with the goal to employ these animals at airports to detect a variety of explosives either carried by persons or in baggage.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

4.0052, DESIGN AND FABRICATION OF A THERMAL NEUTRON EXPLOSIVE DETECTOR

Unknown, Westinghouse Electric Corp., *3 Gateway Ctr., Pittsburgh, Pennsylvania* 15222 (FA77WA-3996; FA160302 (TRAIS NO.))

The contractor shall install and operate the breadboard system to obtain nitrogen content data and nitrogen density data on items at airport locations. Tests shall be conducted at a maximum of three major airports located within 1500 miles of contractor's plant. At each selected airport, a minimum of 500 pieces of luggage and a maximum of 1000 shall be tested with at least 25% containing explosive test articles.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

4.0053, A STUDY OF LOCALIZED PLASTIC DEFORMATION AS RELATED TO FATIGUE MECHANISMS

R.J. Asaro, Brown University, Graduate School, Dept. of Engineering, *University Hall, Box 1883, Providence, Rhode Island* 02912 (DF047680; AFOSR-77-3246)

AF function - certain high-strength structural materials used in aerospace systems (including some aluminum and titanium alloys) are susceptible to the occurrence of strain localization. Opportunity - this phenomenon is due to the development of localized regions which are plastically unstable, and results in severe reductions in fatigue life and ductility. The process is particularly insidious since critical strain for fracture can be locally surpassed at very low average macroscopic strain, thus leading to unexpected premature failure. Objective - this research will - (1) identify the experimental conditions which cause plastic deformation of homogeneous bodies to become localized into intense shear bands, (2) ascertain to what extent these bands cause material damage, crack initiation or contribute to crack growth, and (3) analyze the initiation of plastic localization both as an abrupt degradation or weakening of the material and also as an instability in the constitutive description of plastic flow. How work contributes - this fundamental study will investigate localized plastic deformation, and the role it plays in fatigue mechanisms, metal ductility, and fracture processes.

Experiments will be performed on single crystals and axisymmetric polycrystalline specimens of aluminum-copper alloys in order to precisely document the conditions of stress state, strain rate, work hardening rate, temperature and metallurgical structure which allow localization of plastic flow to occur. Subsequent studies will include 2000 and 7000 - series commercial aluminum alloys.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0054, DISTRIBUTED STORE LOADS PREDICTION

W.B. Baker, Arnold Research Org. Inc., *Arnold Air Force Base, Tullahoma, Tennessee* 37389 (DF421057; F40600-77-C-0003)

To develop techniques to both analytically predict and experimentally measure distributed aerodynamic loads on a store in an interference flow field.

Gross and distributed loads calculations from modified CAMS 045 program will be compared with experimental data. Feasibility of modifying the program to calculate distributed loads in an interference flow field will be investigated. Neilsen store separation program will be considered for possible use in making distributed loads calculations. Design criteria and test requirements will be established for a segmented model to measure distributed loads.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Arnold Engineering Development Center

4.0055, ADVANCED ENGINE EMISSION MEASUREMENT TECHNIQUES

J.D. Few, U.S. Dept. of Defense, Air Force, Arnold Engineering Development Center, *Arnold Air Force Station, Tullahoma, Tennessee* 37389 (DF407680)

New data using optical-in-situ techniques indicate that existing probe-sampling methods may give erroneous results for NO

and CO levels in engine exhaust. The objectives of this project are to document and explain the discrepencies between probe and optical measurements, and to develop compact optical systems for in-situ measurement of NOx and CO in engine exhaust.

(a) Joint funding with AFAPL of AEDC study to determine effect of probe materials and designs on NOx and CO measurements, and comparison with optical-in-situ results. (b) Funding of AEDC study to determine effect of axial distance from nozzle (and therefore temperature) on NOx and CO measurements by probe and optical techniques. (c) Partial funding of AEDC simultaneous measurement of NO and NO2 by optical method.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Civil & Environmental Engineering Development Office

4.0056, NAVY VEHICLE DESIGN AND CONSTRUCTION - MODELING EFFECTS ON V/STOL GROUND-INDUCED FORCES

C. Smith, General Dynamics Corp., *P.O. Box 748, Fort Worth, Texas* 76101 (DN875432; N00014-78-C-0384)

The objective of this research is to investigate model scale effects in the prediction of induced aerodynamic forces and moments on V/STOL aircraft configurations hovering in ground effect. Previous comparisons between model tests and full-scale flight results have shown large discrepancies in induced forces and moments for inground-effect hovering conditions. At least a portion of these discrepancies have been attributed to differences in the jet exhaust turbulence and velocity characteristics between model and full scale. This investigation will quantify the effects of these characteristics and analyze their impact in scaling model results to full-scale conditions.

A series of model tests with two-, three-, and four-jet configurations will be conducted with an existing nominally 1/15 scale model and test rig. Induced forces and moments will be measured and recirculating flow field pressure surveys will be taken for different turbulence intensity levels and velocity profiles. Comparisons with previous baseline data will be made and analysis will be performed to determine trends as functions of these new variables.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0057, ESTIMATION OF CONFIDENCE LIMITS FOR TESTING LARGE LOGIC NETWORKS

J.L. Fike, Southern Methodist University, School of Engineering & Applied Sciences, Dept. of Electrical Engineering & Computer Science, *Hillcrest & University, Dallas, Texas* 75222 (DF050010; AFOSR-77-3461)

AF function - to advance the design of digital avionics systems. Important functions in growing numbers are being performed by digital systems on USAF aircraft. Deficiency - the enormously complex microprocessors that are now being fabricated on a single chip are impossible to test completely, and a methodology is required that will enable digital circuit engineers to devise extremely efficient partial-testing patterns. Objective - to derive collections of tests for microprocessors for use in acceptance testing and for maintenance in the field. How work contributes - the results of this research, if successful, would advance the reliability of on-board computers which are essential for future aerospace vehicles.

Techniques will be perfected that will quickly and accurately yield confidence limits for the probability that a network is working properly. The procedures will depend on the network and the collection of tests that have been applied. Having the confidence intervals for various tests will permit the appropriate choices of tests for maximum effectiveness.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0058, ADVANCED TECHNIQUES FOR ACQUISITION OF METEOROLOGICAL DATA

C. McDonald, University of Texas, El Paso Campus, School of Engineering, Dept. of Electrical Engineering, *El Paso, Texas* 79999 (DA0F2111; DAAD07-78-C-0010)

The objective is to study advanced techniques for acquisition of meteorological data for field Army applications--specifically the prediction of nuclear detonation debris fallout as derived from vertical temperature profile radiometers (VTPT) on polar orbiting satellites and the utilization of remotely piloted vehicles as maneuverable atmospheric probes for the acquisition of meteorological information.

(a) Determine the minimum capability required of a portable microcomputer to convert VTPR radiance data to nuclear fallout prediction data. (b) Design and fabricate a payload consisting of temperature, pressure H2O, O3 sensors (and others as determined suitable), remote data link and power supply and interface this payload with RPV's designed and fabricated and supplied by Johns Hopkins University. Conduct test flights with RPV-borne sensor payloads to characterize the atmosphere over the high-energy laser system test facility at WSMR.

SUPPORTED BY U.S. Dept. of Defense, Electronics Research & Development Command, Atmospheric Sciences Lab.

4.0059, COMPOSITE STRUCTURE OPTIMAL DESIGN BY ENERGY METHODS

R.W. McLay, University of Vermont & State Agricultural College, School of Technology, Dept. of Mech Engin, *85 S. Prospect St., Burlington, Vermont* 05401 (DF042370; F44620-76-C-0012)

AF function - advanced aerospace flight structures require increased durability and performance efficiency. Opportunity - advanced composite materials potentially can fulfill these Air Force requirements in a number of primary structural applications. Objective - the objective of this research is to develop a basic mechanics theory of fracture behavior in order to predict both fracture initiation and fracture surface directional dependence for advanced composites. How work contributes - this research supports the technology base related to advanced composite applications for airframe and engine primary structure.

Research is planned on both a theoretical and experimental level. Theoretical research will continue to develop the maximum entropy rate production theory for predicting fracture behavior. This theory will be used in conjunction with finite-element analysis methods for solving fracture problems in composites and examining the accuracy of the solution results. Experimental research will be pursued to obtain the fracture energy parameters required by the theory and to provide experimental data for comparison with predictions. Interface parameters will be studied especially under conditions where the environment affects the interface toughness. Reliable experiments to measure the parameters must be developed as part of the research effort.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0060, NAVY VEHICLE DESIGN AND CONSTRUCTION - AERODYNAMIC CHARACTERISTICS OF WINGS WITH SEPARATED FLOW

B. Maskew, Analytical Methods Inc., *110 116th Ave. S.E., Bellevue, Washington* 98004 (DN875208; N00014-78-C-0128)

The maneuvering capability of modern fighter aircraft is most often limited by heavy buffet and/or loss of control, both due to flow separation on the aircraft wings. Consequently, the consideration of flow separation in the design and analysis of wings is extremely important. Unfortunately, the exact theoretical computation of these complex flowfields does not appear possible in the foreseeable future. Current linear flow models are not applicable for separated flows. In addition, wing tunnel tests are extremely expensive and often come too late in the design cycle to impact major aerodynamic/structural design trade-offs. It is the objective of this research to develop an approximate numerical model of the flow on three-dimensional wings that will permit computation of the aerodynamic characteristics including the effects of flow separation.

An approximate viscous flow method will be developed to predict areas of separation on the wings. The separated flow region and resulting wake will be modeled using a potential flow code. An iterative procedure will be used to model the viscous/inviscid flow interaction. The basic procedure has already been used very successfully for two-dimensional flows on airfoils.

Both leading and trailing edge flow separation are being incorporated into the model.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0061, HYPERSONIC HEAT TRANSFER MEASUREMENTS

B. Richards, Von Karman Inst. for Fluid Dynamics, *72 Chaussee de Waterloo, Brussels, Belgium* (DF051160; AFOSR-78-3474)

AF function - aerospace vehicles. Deficiency - unpredicted or poorly predicted transition from laminar to turbulent flow on the nose tips of ABRES shapes has caused numerous severe problems of heating and aerodynamic instability. Ground-based flow facilities do not simulate all of the flow parameters of free flight that influence these phenomena. One facility, which is rather economical to operate, located at the VKI, is capable of simultaneous simulation of Mach number and Reynolds number of these flights, while not achieving the sustained, realistic running time. Nevertheless, heat transfer and pressure distribution measurements on a number of nose tip shapes of interest to ABRES appear to be desirable. Objective - to extend and confirm data previously obtained by VKI with AVCO support and coordination, using models manufactured under a previous program. How work contributes - the results of this experimental program will help with the design of nose tips which ameliorate the problem attended to under Deficiency.

The longshot facility of the VKI will be used for this program. Surface pressure and heat transfer measurements will be made at Mach numbers of 15 and 20 and free stream Reynolds numbers between 2 and 8 million per foot. Models to be tested include a concave biconic nose tip model with and without roughness.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0062, AERODYNAMICALLY GENERATED SOUND AND SUBSONIC AERODYNAMICS

H.S. Ribner, University of Toronto, *92 College St., Toronto, Ontario, Canada* M5S 1B2 (DF001050; AFOSR-75-2808)

AF function - advanced aerospace vehicles. Deficiency - lack of understanding of the basic physical mechanisms which produce noise in propulsion systems representative of current and future Air Force aircraft. Objective - examine two of the key physical phenomena associated with high-performance jet engine noise (viz jet exhaust and combustion). How work contributes - understanding of the phenomena will enable the Air Force to remove, or at least suppress, the amount of noise associated with operation of jet aircraft.

An experimental and theoretical investigation on jet noise will be undertaken. Documentation of the relative shear/self contributions by cross-correlating the flow signals with the far-field sound signal will be done via a laser Doppler system. A study of the alternate source terms in the jet flow will be evaluated to attempt to resolve the issue of the sources of jet noise. Work on usefulness of a reflective barrier as a jet noise suppressor will be conducted.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0063, AN EXPERIMENTAL INVESTIGATION INTO THE AERODYNAMIC OUT-OF-PLANE FORCES ON SLENDER BODIES AT HIGH ANGLES OF ATTACK

B. Hunt, University of Bristol, Dept. of Aeronautical Engin, *Bristol, England, United Kingdom* (DA0D9348; DAERO 77 G0073)

The objective of the study is to experimentally determine the side forces on slender bodies at high angles of attack.

Extreme care will be taken to establish a steady flow pattern. This will be achieved by the use of rigidly mounted models in low-turbulence wind tunnels (the 4 x 3ft tunnel of the Royal Aircraft Establishment, Farnborough) and will be checked by continuously monitoring the time-dependent behaviour of the flow. Pressure distributions will be collected over both the nose and the body of a circular cylinder fitted with a range of SHAPR and spherically-blunted noses. Tests will be conducted for incidences from 25 percent to 80 percent and for both subcritical and post-critical Reynolds number ranges. The pressures will be integrated to yield side and normal force distributions and the results will be used to improve an existing prediction method and to assist in understanding the flow field.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Research & Standardization Group

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, ATMOSPHERIC AEROSOLS

P. Chylek, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab., *Boulder, Colorado* 80302 (8AA71177)

PROJECT OBJECTIVE: Theoretical investigation of the effect of nonspherical aerosol particles on the interpretation of remote sensing data.

CURRENT YEAR PLAN: Perform a set of numerical calculations of the light scattering by nonspherical particles for several different shapes and refraction indices. The purpose will be to find out the similarities and differences between the scattering of nonspherical particles and spheres of the same volume, surface area, and geometrical cross sections.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab.

5.0002, MARINE FOG FORMATION

A.H. Woodcock, (No Performing Organization Reported), *Hawaii* (DN323054; N00014-73-C-0371)

As part of a larger project on marine fog, the objective of this research is to identify factors that lead either to saturation of the marine boundary layer, or other mechanisms that make fog formation possible. Attainment of the objective would lead to needed improvement in fog forecast at sea.

Data for this research is gathered from various marine environments in which fog frequently occurs. Data gathered includes the number density and size spectrum of sea salt nuclei when no fog is occurring. Additionally, the sea salt nuclei data is also gathered during meteorological processes that enhance bubbling at sea such as rimed snow flakes, small hail, or snow flakes falling into the sea.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0003, REMOTE SENSING STUDY OF RECREATION BOATING USE

R.C. Heller, University of Idaho, School of Forestry Wildlife & Range Sciences, Dept. of Forest Resources, *Moscow, Idaho* 83843 (0072416; IDA-ES-0120)

OBJECTIVE: Identify boating use on six northern Idaho lakes by visual observation and aerial photography.

APPROACH: Vertical and panoramic aerial photography was for this study by the Idaho Air National Guard on selected Sundays during summer 1976. Photo interpretation was done directly from the black and white negatives and compared by boat type, location on lake relative to recreation facilities. On Lake Coeur d'Alene, visual observations were taken on two dates and recorded by an event recorder.

PROGRESS: Aerial photographs were taken of six lakes which have moderately high recreation use in northern Idaho. The Idaho Air National Guard took the photos on six weekends in summer 1976 with a panoramic camera. Photo interpretation counts were made of boating type, marinas and docked boats on black and white negative film. Visual observation techniques were developed and used over Lake Coeur d'Alene on two weekends. Maps of boat locations by type were drawn and calcu-

lations made of area of use by each boating type. Recommendations for increase or decrease of boating activities will be made.

SUPPORTED BY Idaho State Government

5.0004, IMPROVEMENT OF CROP PLANTS FOR SOUTHWESTERN KANSAS

M.D. Witt, Garden City Branch Agricultural Experiment Station, *Garden City, Kansas* 67846 (0013393; KAN00297)

OBJECTIVE: Compare varieties of various crops for yield, disease and insect resistance, and adaptability to southwestern Kansas conditions, and test methods of production such as rates and dates of planting.

APPROACH: Test plots of a wide selection of crops are planted on both dryland and under irrigation. Rates are taken of all discernible characteristics and yields are determined at the appropriate times.

PROGRESS: Studies conducted during 1977 consisted of irrigated and dryland crops with varieties and/or hybrids of winter wheat, winter barley, alfalfa, soybeans, sunflowers, forage and grain corns, forage and grain sorghum. New breeding lines under observation included lines of wheat, barley, sorghum, and a bulk population of pearl millets. Cody alfalfa had the best longevity of varieties tested. Elf soybeans indicated that semi-dwarf types are too short for Garden City. Hybrid sunflowers generally had better stalks and better yields than the varieties. Semi-dwarf wheats have potential under irrigation but emerge poorly with deep planting. Hybrid wheats did not yield better than the parent varieties and were taller. 'Ground Truth Readings' on small grain plots were used in the LACIE satellite project. World wheat acreage and production estimates are being made with this technique. Greenbug resistance in sorghum hybrids varies in effectiveness with their source of resistance. With 4,000 greenbugs per plant, yields were improved with an insecticide and good genetic resistance. Two soft white winter wheats yielded poorly but three new hard white winter wheat lines yielded as well as hard red winter wheat. Lancota and Plainsman showed about 1% more protein than other wheat varieties under both normal and 2X fertilizer rates. Natural hybrids of goatgrass with wheat were sterile. Dwarf Essex winter rape planted October 15 winterkilled.

SUPPORTED BY Kansas State Government

5.0005, IMPROVED ROCKETBORNE PZL DENSITOMETER PAYLOADS

D.H. Fryklund, Accumetrics Corp., *Cambridge, Massachusetts* (DF249630; F19628-77-C-0163)

AF function - airborne surveillance and weapons delivery. Deficiency - improved accuracy required for low-altitude satellite ephemerides and impact prediction for operations AF RV's and weapons systems. Research - rocketborne instrumentation and improved telemetry for accurate density measurements in 50-150 km altitude range. How research contributes.- density data in this altitude range can contribute significantly to improved impact prediction capability for ICBMs, RVs, increased computational accuracy for satellite ephemerides and improved mode atmospheres that result from an increase in the density data base.

Work to be performed on this contract will consist of the development, fabrication and testing of operational rocketborne falling sphere instrumentation that will enable atmospheric density to be determined with improved accuracy in the altitude region between 50 and 150 km. In addition the work will include system analysis based upon previous flight results. This will provide an opportunity for in-depth evaluation of flight performance in order to attain improved reliability and survivability. Rocketborne density payloads using hardware developed under this contract will be launched at selected sites in accordance with AF programs and requirements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0006, AIRBORNE MARINE FOG STUDY

R. Markson, Airborne Research Associates, *46 Kendal Common Rd., Weston, Massachusetts* 02193 (DN890075; N00019-78-C-0289)

To study micrometeorological processes and properties in the lower atmosphere as related to the propagation of electromagnetic energy. This knowledge is required to develop realistic atmospheric models for use in propagation codes.

A specially instrumented aircraft will be used to measure significant atmospheric properties in the lower atmosphere over the ocean and over inland desert terrain. Aerosols, turbulence, and water vapor are of prime interest.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

5.0007, SATELLITE DENSITY SYSTEMS

C. Accardo, Epsilon Labs. Inc., *Bedford, Massachusetts* (DF580470; F19628-77-C-0062)

AF function - low-altitude operational satellites, airborne surveillance, ballistic nuclear weapon delivery. Deficiency -inacurracies in spacecraft's orbital track and trajectories due to insufficient knowledge of atmospheric density variability at critical altitudes. Objective - acquisition of atmospheric density measurements, define, analyze, correlate and relate results to solar and geophysical phenomena. How research contributes - permits direct accurate measurements of density providing inputs needed in the development and upgrading of forecasting techniques.

Instrumentation using ionization gauges along with a motor-activated air stream modulator has been developed for use onboard the S77-2 spacecraft. These flight units are capable of measuring directly atmospheric density and also potentially atmospheric temperature and spacecraft attitude.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0008, 118 GHZ RADIOMETER

D.H. Staelin, Massachusetts Inst. of Technology, School of Engineering, Dept. of Electrical Engin, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DF245370; F19628-75-C-0122)

AF function - weather analysis and forecasting for military operations. Deficiency - inability to determine meteorological conditions over inaccessible or unfriendly territory. Objective - to develop new and advanced equipment and techniques to better utilize the microwave vertical probing capability of the Defense Meteorological Satellite System (DMSS). How development contributes - improves the ability to infer and forecast atmospheric temperature profiles and determines both qualitative and quantitative limits of probing cloud structure. This will allow determination of whether or not 100-200 gHz equipment should be flown on DMSS in the 1980 time frame, and the necessary and optimum processing of satellite data.

A receiver will be constructed utilizing a solid-state mixer diode for switching and a frequency-locked klystron serving as a local oscillator.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0009, TROUGH WALL MODEL STUDIES

T.B. Barrett, Parke Mathematical Labs. Inc., *1 River Rd., Carlisle, Massachusetts* 01741 (DF248200; F19628-76-C-0296)

AF function - communications and detection. Deficiency - sufficiently accurate corrections for range/azimuth errors of OTH radar systems due to propagation in the high-latitude ionosphere. Prediction and real time specification of disturbances in auroral and equatorial ionosphere. Objective - to study the errors in OTH radar range and azimuth measurements introduced by changes in the structure of the f-layer trough wall. To study effects of the known variability of the trough wall. To investigate signal characteristics as spectral components and amplitude probability distribution for VHF/UHF satellite signals received under equatorial/arctic scintillation conditions. How research contributes - improvements of OTH radar test and operating procedures based on theoretical error predictions. Improvements of satellite communications systems in terms of improved technical specifications and operating procedures.

For specific combinations of radar frequencies and antenna parameters, 3-dimensional ray tracing will be used to determine

the deviation in azimuth and the changes in expected range and energy density of the beam in the landing area caused by the electron density gradient in the ionospheric trough wall. Computations will be made using a median gradient model of the poleward mid-latitude trough wall, and also using variations in electron density of trough and variations in gradient values of the trough wall. Computer programs will be adapted to allow processing of airborne scintillation data to obtain power spectra, amplitude probability distributions and scintillation indices. An attempt will be made to correlate the structure of equatorial and auroral irregularities with airborne scintillation observations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0010, INSTRUMENTATION DEVELOPMENT FOR LASSII EQUATORIAL MEASUREMENTS

Unknown, Tri Con Associates Inc., *Cambridge, Massachusetts* (DF581830; F19628-78-C-0150)

AF function - maintain communications between Air Force units during periods of small-scale ionospheric irregularities. Opportunity -model can be developed to provide inputs to systems designer to mitigate the effects of small-scale ionospheric irregularities on VHF/UHF transionospheric radio signals. Objective - develop an instrument capable of making positive ion composition measurements with a very high spatial resolution at satellite velocity. How research contributes -provides measurements essential to an understanding of the physical-chemistry and transport processes involved in the creation of ionospheric irregularities.

A quadrupole mass spectrometer instrument capable of making positive ion composition measurements with a spatial resolution of three meters at satellite velocity shall be developed. Three such instruments shall be fabricated for ensuing flights on STP program NRL-sponsored, LASSII satellites.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0011, ELECTRON AND ION BEAM SYSTEMS

H.A. Cohen, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF249270)

AF function - communication satellites in geosynchronous orbit. Deficiency - electrical charging of satellites by ambient particles causing anomalous switching in electronic circuitry. Objective -development, testing and use of charge ejection systems to duplicate, prevent, or control satellite charging. How research contributes - by the development, testing and use on space vehicles of charge ejection systems, charging of satellite surfaces can be controlled for predetermined periods, obtaining either large or small potential differences with respect to ambient plasma.

A satellite electron beam system (SEBS) and a satellite positive ion beam system (SPIBS), are being developed, built, and tested, using a combination of contractual efforts, and in-house AFGL laboratory work. These efforts are being coordinated with those responsible for SCATHA to obtain instruments with the optimum specifications in terms of the required measurements and the satellite's physical and electrical requirements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0012, A DESCENT CONTROL TECHNIQUE FOR HIGH-ALTITUDE BALLOONS

J.F. Dwyer, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF582380)

AF function - advanced balloon systems (surveillance, delivery, operations, environmental research support and space equipment test). Deficiency - no method exists whereby controlled balloon system descent can be instantaneously initiated. Objective - predictable, controlled balloon system descent, with nearly zero time delay in response to command, will be demonstrated and documented. How research contributes -this proposed technique will have immediate application to problems such as descent profile control for atmospheric sampling and measuring (e.g. P-6687), horizontal balloon flight trajectory control by rapid descent to take advantage of favorable wind fields, rapid controlled descent to lower altitudes to thereby reduce parachute opening shock.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0013, SPECTROMETER FOR ULTRAVIOLET HORIZONS MEASUREMENT

R.E. Huffman, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF581310)

AF function - spacecraft guidance and control, target detection and tracking, surveillance. Deficiency - insufficient information on ultraviolet horizons to develop horizon sensors. Objective -development of a spectrometer to measure the ultraviolet horizon from a satellite or shuttle, including altitudinal variation, global variation and spectral characteristics. How research contributes - the radiance from the earth's atmosphere as a function of the viewing direction is the primary measurement required to develop improved horizon sensors for spacecraft altitude control. The stability, spectra, and intensity will be obtained from the experiment obtained under this work unit.

The horizon limb profiles will be measured in the ultraviolet and vacuum ultraviolet wavelength regions using small spectrometers. These Ebert-Fastie spectrometers will allow the necessary wavelength band discrimination. A telescope will isolate a small field of view. Prototype units will be tested in regard to sensitivity as a function of wavelength and irradiation direction. A group of these modules will be incorporated into a satellite or shuttle experiment.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0014, REAL TIME DATA DISPLAY USING COMPUTER TECHNOLOGY

R.D. Yoho, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580670)

AF function - pre-flight preparation of sounding rocket and satellite scientific payloads. Deficiency - larger and more complex scientific payloads are currently being developed for flight. Higher PCM bit rates are being used. These factors make payload checkout a long, tedious, and error-prone task when accomplished with currently available PCM equipment. Objective - develope a reliable system for rapid pre-flight evaluation of scientific payload performance. How research contributes - improved payload checkout capability by use of state-of-the-art high-speed computer techniques.

A high-speed minicomputer will be used to perform number base conversion and to display scientific information in engineering units. This would allow payload performance evaluation in real time. In addition the system could be easily re-programmed to accommodate a wide variety of PCM bit rates, formats, and specific data display requirements. A hardware interface between the minicomputer and PCM decommutation equipment will be designed and built. This interface will provide synchronization between the computer and the PCM telemetry system. The technical base developed under work units 76590101 and 76590102 will be used to develop new dedicated software both for interface checkout and PCM data manipulation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0015, THEORETICAL STUDY OF PLASMA EXCHANGE BETWEEN F-REGION AND MAGNETOSPHERE

D.G. Torr, University of Michigan, Ann Arbor Campus, Graduate School, *Rackham Bldg., Ann Arbor, Michigan* 48104 (DF248710; F19628-77-C-0007)

AF function - ionosphere and magnetosphere modelling and prediction, communication, surveillance, navigation. Deficiency - inadequate knowledge of interaction between different ionospheric constituents and of equations governing their transport at all altitudes. Objective - to model the motion of different ionospheric ion species along and across magnetic field lines at low

and mid-latitudes. How research contributes - the new code will give a means of predicting changes in relative abundance, density and motion of ionospheric and magnetospheric constituents at mid-latitudes. This will improve understanding of and prediction of plasma depletion and irregularities in the ionosphere which degrade performance of AF communication and surveillance systems whose ray paths traverse mid-latitude ionospheres.

A computer code will be constructed to model the motion of ionospheric ions using newly developed computational techniques which allow independent treatment of different ion species over a range of solar-geophysical conditions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0016, SEA ICE REMOTE SENSING INVESTIGATION

W.J. Campbell, U.S. Dept. of the Interior, Geological Survey, *12201 Sunrise Valley Dr., Reston, Virginia* 22092 (7-441; 01-8-M01-5936)

OBJECTIVE: Design and implement sea ice remote sensing experiments which will contribute to the development of sea ice dynamics, models and prediction techniques, and assist in defining appropriate sensors and analysis techniques for future satellite systems.

APPROACH: Continue analysis of remote sensing and surface data collected during the period of AIDJEX 1970-76. Relate to SEASAT-A and Nimbus-G microwave teams to insure optimum attention to sea ice remote sensing requirements. Commence acquiring Seasat SAR and SMMR data over sea ice areas, and conduct analysis in conjunction with aircraft data. Analyze altimeter data from Greenland Ice Sheet.

PROGRESS: Analysis of AIDJEX remote sensing data is expected to be completed by end of FY77 and will be fully reported on when completed. Experiments relating to Seasat data are in preparatory stages.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0017, PLANT ECOLOGICAL INVESTIGATION OF THE OKAVANGO RIVER SYSTEM IN BOTSWANA

P.A. Smith, Botswana Agricultural Research Dept., *P.O. Box 107, Maun, Botswana*

OBJECTIVE: Determination of the principal plant communities and their distribution within the Okavango River drainage system within Botswana.

APPROACH: (1) Identification of vegetation types by stereo examination of aerial photographs (and such LANDSAT imagery as available). (2) Recording of plant transects conducted (a) at intervals, fixed in space, along all major channels and (b) randomly at sample sites in all vegetation types away from channels. (3) Gathering of plant specimens for determination by the major, international herbaria and the establishment of as complete as possible a reference collection of all vascular plants for the Botswana Okavango area and its environs.

PROGRESS: In view of the large size of the area under study (over 16,000 square km), the small size of the team, and logistical problems caused by the remoteness and lack of accessibility in the major parts of the swamp section, a specially modified system of plant sampling has had to be employed and emphasis placed on covering as wide a variety of sites as possible. To date (April 1979) 90% of channel transects completed but only approximately 20% of off-channel sites visited.

IMPORTANT NOTE: Study of the vegetation of saline sites forms only a small part of the total investigation because such sites are of limited occurrence and it has so far not been deemed necessary to give them special priority over the considerably more extensive non-saline areas.

Ecological parameters for terrestrial studies: Latitude, 18-21 degrees S; Altitude, 932-994 meters; Soil types, various; Mean annual temperature, 22.2 degrees C; Months of greatest moisture, December-March; Growing season, 180 days; Mean annual rainfall, 472-520 mm; Mean annual humidity, 51.3 percent; Number of wet seasons, one.

Ecological parameters for aquatic studies: Latitude, 18-21 degrees S; Water salinity, 36-540 in channels micromhos/cm (Maun, surface); Water temperature, 15-30 degrees C.

SUPPORTED BY Botswana Government

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, TRANSFER EFFECTIVENESS OF SIMULATOR MOTION AND SIMULATED IFS FIELD OF VIEW

M. Nataupsky, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Williams Air Force Base, Chandler, Arizona* 85224 (DF223030)

To compare the levels of skill acquisition and training transfer for selected basic and instrument flight maneuvers as a function of platform motion (full versus no motion) and field of view (full vs. simulated IFS) using ASUPT.

The research will be conducted in two phases. In phase I each group of four UPT students will receive ASUPT training under one set of conditions on selected contract flying maneuvers including takeoffs, straight-in and pattern landings. The four conditions are- 1. Full platform motion and full (ASUPT) field of view, 2. Full platform motion and restricted (ATC/IFS) field of view, 3. No platform motion and full field of view, and 4. No platform motion and restricted field of view. Performance in ASUPT will be measured via the ASUPT automated performance measurement system and IP ratings. Transfer will be measured by IP rating on an expanded 12-point scale. Phase II of the research will emphsize instrument flying skills including GCAS. The same students used in phase I will receive additional ASUPT training. The procedure in phase II will be similar to phase I except half the subjects receiving the no-motion and half receiving the full platform motion in phase I will receive the full platform motion treatment in phase II. The remaining subjects will receive the no-motion treatment in this phase.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0002, MODELING BIODYNAMIC EFFECTS OF VIBRATION ON PILOT CONTROL

H.R. Jex, Systems Technology Inc., *13766 S. Hawthorne Blvd., Hawthorne, California* 90250 (DF036930; F44620-73-C-0075)

AF function - in the course of routine operations, Air Force personnel are exposed to a wide range of environmental stresses which seriously limit mission performance. Vibration is one of those stresses receiving increasing attention due to the number of low-altitude, high-speed flights, transonic buffeting of fighter pilots affecting the use of helmet-mounted sights, and the increased use of vertical/short take-off and landing aircraft. Deficiency - technology for modeling, analyzing, simulating and designing man-machine systems in these biodynamic situations is needed. Objective - the various phases of this research program have the primary objective of developing analytical, dynamic models of the biomechanical and control effects of vibration on a pilot's control behavior and performance, which are usable by Air Force system engineers and applied researchers in the field. How research contributes - this research should lead to models to assist in establishing design criteria and is identified in RO 1.6, 'Aircrew Safety and Effectiveness in Mechanical Force Environments.'

This effort will employ the latest state-of-the-art in systems dynamics and analyses techniques to assist in the measurement and modeling of pilot behavior (i.e., describing functions, remnant, feedthrough functions) and performance (e.g., errors, coherency, stability margins, visual impairment, etc.), under various types of vibration (sinusoidal, random, vertical, lateral, etc.) in experiments provided by the 6570 AMRL/BB Branch at Wright-Patterson AFB. This approach will 1) analyze recent experimental data of STI, AMRL/BB, and others, to provide describing functions for the head-eye motion suitable for the computerized model, 2) provide a user-oriented computerized program for the 1977 STI biodynamic model which can provide the biomechanical transfer functions required as inputs to the AMRL PIVIB program, and be used for close-loop pilot-vehicle analyses where motion feedback is crucial (e.g., pilot-induced oscillations), 3) assist in planning a new series of semi-supine pilot

vibration experiments (including helmet sights) at AMRL/BB, monitor the runs and provide limited data analyses in the areas of head and eye motion modelling.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0003, NEUROPHYSIOLOGICAL RESEARCH IN ADAPTIVE NETWORK ARCHITECTURES

C.D. Woody, University of California, Los Angeles Campus, School of Medicine, Dept. of Physiology, *924 Westwood Blvd., Suite 400, Los Angeles, California* 90024 (DF043620; AFOSR-76-3074)

AF function - the Air Force needs new methodologies for the design of improved adaptive networks which are applicable to artificial intelligence operations such as automated image recognition, speech coding and decoding, robotics, and computer-aided decision-making. Deficiency - both brain and machine depend on component operations. There is reason to believe that systems supporting complex, goal-seeking adaptive behavior are best constructed from goal-seeking adaptive components. Limited understanding of how such components work has prevented their incorporation into artificial intelligence systems. Objective - the general objective is to improve the ability to design adaptive network architectures by investigating neuronal adaptive mechanisms underlying intelligent information processing in the brain. How work contributes - this research should lead to an improved understanding of the control of adaptive mechanisms underlying information processing by the brain and afford the design of improved components for use in artificial intelligence. This research is in direct support of related efforts at System Avionics Division, AF Avionics Laboratory.

The brain is the most powerful adaptive network known and the basic component of the brain is the neuron. Recent studies indicate that single cortical neurons adapt in relation to adaptive mammalian behavior. By investigating these adaptive neural elements it is hoped to determine if cellular mechanisms controlling this adaptation operate in a goal-seeking manner, which might involve maximization of excitatory or inhibitory conductances, cyclic nucleotide gradients or other measureable variables that influence the level of neural excitability. The approach is to study control of changes in cellular excitability directly in single cortical neurons.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0004, IMPROVED CIG EDGE UTILIZATION STUDY

M. Bunker, General Electric Co., *P.O. Box 2500, Daytona Beach, Florida* 32015 (DF228120; F33615-77-C-0033)

To develop new algorithms which will improve edge utilization in wide field-of-view (FOV) CIG visual simulation systems. In current wide FOV CIG systems, the edges are distributed over a large viewing angle, resulting in poor image detail. The poor image detail, in turn, reduces the training effectiveness of the system. This study will develop algorithms which will concentrate the CIG edges into the primary pilot viewing areas. The pilot will be provided more and better visual cues without additional edges being processed by the CIG system. This improved utilization of edges will increase the training cost effectiveness of future CIG systems.

To analyze and develop two algorithms which will improve edge utilization of future CIG systems. These algorithms are for (1) new level-of-detail (LOD) change criteria and (2) a real-time, dynamic area-of-interest (AOI) image over a background scene. In current systems, the LOD change criterion is based upon nadir range. However, altitude, attitude and slant range are additional parameters which could be used to improve and increase the utility of the LOD algorithm. In the LOD algorithm to be developed, the above examples and other parameters are to be analyzed for use as new LOD change criteria. With this new LOD algorithm, the edges will be concentrated in the pilot's primary viewing area. In large FOV visual simulation systems, the pilot uses only a small, highly detailed FOV, termed AOI, at one time. If this AOI is constantly slewed to the pilot's look angle, the pilot will always view a highly detailed AOI image with a low detailed peripheral image. An algorithm will be developed which provides this dynamic detailed AOI without additional edges being processed by the CIG system. The algorithm will be used for generating the AOI but does not include methods of directing the AOI. Methods of detecting helmet position are being developed by AMRL and other organizations. This work will be drawn upon for determining the position of the pilot's eyes for directing the location of the AOI.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0005, EXPLORATION OF THE RELATIONS BETWEEN EYE COLOR, SELECTED PHYSIOLOGICAL MEASURES AND INDIVIDUAL NOISE SUSCEPTIBILITY

N.G. Hoger, U.S. Dept. of Defense, Navy, Naval Aerospace Medical Research Lab., *Pensacola, Florida* 32512 (DN877532)

To explore the relations between eye color, selected physiological measures and individual noise susceptibility. Identification of any such relationships would have implications toward the prevention of noise-induced hearing loss among naval personnel working in potentially hazardous noise environments.

Examine the extensive audiometric data obtained from subjects in the thousand aviator study and subjects in the control group of the repatriated prisoner of war (RPW) study. From the records of those subjects exhibiting hearing levels of 50 db or greater at 3000, 4000 or 6000 Hz (subject group I) and those subjects exhibiting hearing levels of 25 db or less at 500 through 6000 Hz (subject group II), determine eye color, percent body fat, systolic and diastolic blood pressures (sitting and supine), serum uric acid, cholesterol, and triglycerides. Conduct appropriate statistical analyses to determine possible relations between individual noise susceptibility, eye color and the various physiological measures. If findings warrant, develop a research plan to conduct selected tests on those subjects returning to Pensacola for medical follow-up as part of the thousand aviator and RPW/control group studies.

SUPPORTED BY U.S. Dept. of Defense, Naval Medical Research & Development Command, National Naval Medical Center

6.0006, HIGH MACH ESCAPE SYSTEM PROTECTION REQUIREMENTS RESEARCH

P.R. Payne, Payne Inc., *Rockville, Maryland* (DF320350; F33615-76-C-0530)

The objectives are to (1) determine forces acting upon crewmen during emergency ejection/extraction from an aircraft flying at transonic and supersonic velocities, (2) measure the influence of crewmen body position upon escape system stability and (3) to develop design criteria for conceptualization of techniques to provide crew protection in high-Mach and high-Q environments.

This investigation includes both analytical and wind tunnel experimental efforts. Experimentation at low velocities will use a full-scale ejection seat and anthropometric dummy to determine the most productive configurations to be evaluated in high-velocity, 1/2 scale tests. High-velocity tests will be accomplished by the government using a 1/2 scale model of the crewman and instrumentation provided by the contractor. Data from wind tunnel tests will be analyzed and reported by the contractor. The analytical effort is directed toward estimation of inertial and aerodynamic forces acting on ejecting crewmen to cause injury and development of requirements for design of personnel protection systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0007, HUMAN FACTORS ENGINEERING IN SUPPORT OF ARMY AVIATION

C.A. Fry, U.S. Dept. of Defense, Army, Army Materiel Development & Readiness Command, Human Engineering Labs., *Aberdeen Proving Ground, Maryland* 21005 (DA0C4955)

To devise means of simplifying helicopter crewstation through effective control/display integration for enhancing mission performance in night, terrain flying operations. Establish human performance criteria for performing aircraft maintenance in the forward area under night conditions.

Design parameters will be established for optimizing the interaction of the aircrew with the helicopter through a process of analysis, mock-up simulation, and flight test. The major problems to be addressed are control/display arrangement in the cockpit, CRT integration, symbology parameters, navigational accuracy, communication simplification, target hand-off and aircraft control simplification. Maintenance tasks will be analyzed to ascertain potential for simplification and the value of tactile cues for night, forward area operations. A focal point of cockpit instrumentation will be established to insure sound integration of all equipment which interfaces with the crew.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Human Engineering Labs.

6.0008, JET-LAG PREVENTION - PHYSIOLOGICAL MECHANISMS AND PHARMACOLOGICAL THERAPY

M.C. MooreEde, Harvard University, Boston Campus, School of Medicine, Dept. of Surgery, *25 Shattuck St., Boston, Massachusetts* 02115 (DF051620; AFOSR-78-3560)

AF function - the continuing sophistication of Air Force operations places increasing demands on the performance capabilities of aircrews and ground support personnel. There is a need to maintain, at the highest level possible, a physically and mentally alert aircrew and support population to achieve maximum utilization of performance capability. Deficiency - symptoms of 'jet-lag' are suffered by Air Force personnel as well as the millions of civilians who travel across time zones. Jet-lag is characterized by deterioration in performance, malaise, inability to concentrate, and other physiological and psychological symptoms. A similar syndrome is suffered by ground crews who work on shift-work schedules as well as combat forces who must function around the clock. Until recently little has been known about the mechanisms of jet-lag and there have been no very effective methods of prevention. Objective - to examine the physiological mechanisms underlying the jet-lag syndrome and to develop therapeutic procedures to prevent it. Recent advances in the pharmacological control of biological clocks indicate that it should be possible to reset them in such a way that the problems of jet-lag could be prevented. Effects of environmental time-zone shifts on circadian rhythms organization and on psychological performance indices of jet-lag will be examined, as well as the therapeutic efficacy of several classes of pharmacological compounds which from studies in lower organisms could form the basis of a 'jet-lag' pill. Will also investigate potential side effects and the long-term effectiveness of the therapy. A goal is to identify a compound or compounds which appear to be therapeutically effective in minimizing jet-lag symptoms, are safe in their actions, and are suitable for testing in human clinical trials. Contribution - supports subarea 1.5, 'Aerospace Medicine'.

The research program will examine the efficacy of candidate bio-clock resetting pharmaceutical compounds using a trained squirrel monkey preparation developed in the laboratory which has a circadian timing system very similar to that in man. Special behavioral tests will be developed to assay performance decrements due to jet-lag and to indicate whether they are reduced by therapy. The dosage, timing and chemical specificity of therapy will be defined. (Text abridged.)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0009, VISUAL DISPLAY INTEGRATION FOR ADVANCED FIGHTER AIRCRAFT

J. Wolf, Honeywell Inc., *2600 Ridgeway Parkway N.E., Minneapolis, Minnesota* 55413 (DF323690; F33615-77-C-0537)

To provide a systematic definition and assessment of optional visual display design approaches for future tactical fighter aircraft employing advanced technology. During FY 77 this contract will begin (1) a planning and technical framework for a phased, multi-year development and evaluation of cockpit design alternatives, and (2) a series of engineering trade-off comparisons among alternative approaches for visual display integration. This effort is needed because reduced cost dictates smaller size vehicles which reduces panel space for cockpit control/display, as typified by the F-16. At the same time, technology can provide an overwhelming amount of flight data and new flight modes previously unavailable, while cockpit designers lack data on the interaction of new technologies and resulting impact on the crew.

This is the third of three contract efforts (triple award) aimed at developing better methods and criteria for interfacing tactical aircrews within advanced technology fighter aircraft (operational capability post - 1985). Visual display design alternatives will be derived based upon mission requirements analyses, crew size/function options, and potential (aircraft, avionic, and display system) technology combinations. Engineering trade-off comparisons among alternatives will determine the impact of specific applications of advanced display technology upon aircrew needs, capabilities and cockpit configurations. Figures of merit used in the trade-off analysis will include performance, safety, survivability and cost. Promising alternative designs may be selected for detailed development and evaluation under a follow-on contract.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0010, THE INVESTIGATION OF METABOLIC AND CARDIOVASCULAR RESPONSES TO FATIGUING STATIC EFFORT

A.R. Lind, St. Louis University, School of Medicine, Dept. of Physiology, *1402 S. Grand Blvd., St. Louis, Missouri* 63104 (DF034830; AFOSR-76-3084)

AF function - this effort involves comprehensive studies of the metabolic, cardiovascular and respiratory responses to muscular exercise and the assessment of the relationship of physiological conditioning. Endurance and fatigue and their relationship to aircrew performance is of utmost interest to the Air Force. Deficiency - the proposed research is a logical extension of the PI's previous work in skeletal muscle physiology but with emphasis on female subjects. Basic question regarding the comparability in skeletal muscle strength and endurance between men and women is particularly significant to the USAF because of the current emphasis on full utilization of women including flying. Objective - this effort will focus attention on the investigation of the ability of females to exert isometric strength to maintain sub-maximum tensions to fatigue and to the recovery of both strength and endurance after fatigue. The physiological responses of the women subjects will also be measured. How research contributes - this research directly addresses research needs identified under subareas 1.6 and 1.5.

Experiments using male and female subjects will be conducted to investigate the causes of muscular fatigue and the differences in those causes that exist between men and women. Aspects to be studied include -relationships between isometric strength and endurance at four different sub-maximal tensions, at varying muscle temperature, assessment of loss of isometric endurance in successful contractions held to fatigue when the intervals between contractions is varied 3-20 mins, determination of the rate of recovery of muscles to exert maximal strength and to sustain sub-maximal isometric contractions after the development of fatigue at varying tensions less than MVC, measurement of local blood flow to muscles performing sustained sub-maximal tensions at controlled muscle temperature in women who are or who are not taking oral contraceptives.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0011, ANALYSIS OF AERODYNAMIC DECELERATION INJURIES DURING EMERGENCY ESCAPE

S.P. Combs, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF321450)

Injuries caused by aerodynamic deceleration during emergency escape from high-performance aircraft using open ejection seats are a serious problem under non-combat conditions and a major combat ejection problem. These injuries, which may be life-threatening at their onset, also increase the possibility of fatality in final phases of escape, i.e., parachute opening shock, descent, landing impact, post-escape survival and rescue. Aeromedical criteria must be established to support development of protective equipment. The objective of this effort is to: (1) provide medical descriptions of operational injuries, (2) determine

the injury mechanisms, (3) establish a basis for prioritizing biomechanical research on this problem and (4) provide aeromedical criteria for injury prediction models and protection techniques.

All accident reports from 1965 to present in which there is a possibility of injury from aerodynamic deceleration will be reviewed in detail. The review, accomplished in collaboration with the Deputy Inspector General for Inspection and Safety, will include analysis of ejection conditions, flight surgeon's evaluation of injuries, X-rays and long-term effects of the injuries. Injuries occurring during the investigation will be studied directly on a physician-to-physician basis. Research results will be made available to the Naval Air Systems Command as well as USAF laboratories and product divisions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0012, NOISE CONSULTATION AND RESEARCH FOR US EPA

D.L. Johnson, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF321270)

The EPA is directed by the Noise Control Act of 1972 to regulate noise in the United States to within exposure conditions that are safe and acceptable from a health and welfare standpoint. The objective of this effort is to provide noise effects research on problems of mutual EPA/USAF interest and also to provide consultation on the entire spectrum of noise exposure problems based upon the extensive AF noise experience over the past three decades. The research results will provide a technology base for use by EPA in the promulgation of their regulations and the technical noise expertise will provide analytical reviews, comments and recommendations regarding research proposals, programs and strategies considered for use by EPA.

The approach is for AMRL scientific and technical personnel to conduct and monitor research efforts of mutual AF/EPA interest in the safety and effectiveness of persons in noise environments. AMRL will also provide consultation by responding to specific requests to review EPA documents, practices and programs as well as those proposed and implemented by other agencies. Since a majority of these requests occur without prior notice and in a rather random fashion, it is impossible to project a schedule of events.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0013, HEARING RISK DUE TO COMMUNCIATION SIGNALS

R. McKinley, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF322960)

Effective voice communication in high-level noise environs may require air and ground crew personnel to increase the intensity of the signal to a level that is damaging to hearing. The objective of this effort is to measure ambient noise and voice communication signal levels under standard AF communication devices during a variety of air and ground operations, to quantify the hearing damage risk and to consider alternate operating procedures that eliminate such risk. This effort will benefit the SG, ASD, life support SPO, base bioenvironmental engineers, as well as air and ground crew effectiveness and safety.

The approach incorporates the field measurement of the acoustic signals under standard AF voice communication devices in a wide variety of air and ground operational environments. Measurements will utilize a precision miniature tape recorder and miniature microphone positioned at the ear under the communication devices. Data will be analyzed in the laboratory to identify operational situations with the risk potential, factors contributing to the problem and possible remedies.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0014, CONFUSION SYSTEMS

R.D. Odonnell, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF321070)

To develop a fundamental data base on the mechanisms of visual sensation and perception capable of disrupting optical tracking and target identification. From the population of visual functions used in tracking and identification tasks, to isolate those which are capable of being distorted by some external manipulation. For these functions, to define the parameters within which such distortion might occur. The ultimate objective is to develop a systematized base of data from which the 'area of confusability' of any given visual function can be readily identified. This base will then permit objective definition of potential countermeasures in terms of a priori probability of success. Supports AFSC development goals S0-5, TC-5 and TC-8.

A committee on high-level national figures will be organized under a separate workunit to outline, in broad form, the visual functions most susceptible to disruption. This committee will similarly define risk/payoff matrices, and will identify additional requirements in the area of visual factors of optical countermeasures. These visual factors will then be studied in terms of the spatial, energy, spectral, and/or temporal parameters comprising them. Laboratory studies will be conducted to assess the impact on visual perceptual processes of manipulations of these parameters. An extensive literature search will be carried out to systematically identify work in which such parameters have previously been established. From these sources, definitive confusability matrices will be evolved. From a broader view, when enough information has been gathered to define these matrices, a describing function relating operator performance to broad ranges of sensory and cognitive perturbations will be developed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0015, JTIDS SYMBOLOGY AND WORKLOAD

W.H. Pearson, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF323380)

The Symbology Standardization Committee (SSC) of the ESD JTIDS SPO has recommended symbology to be used on a joint tactical information distribution system (JTIDS) display during a flight test of the design concept. The objective of this workunit, in compliance with further recommendations of the SSC, is to evaluate the proposed symbols, identify symbols which can be processed more rapidly, and evaluate the workload imposed by use of the JTIDS display in a simulated tactical environment. A summary and synthesis of pertinent literature will also be prepared.

A progressive series of related experiments has been planned ranging from research obtained under a 6.1 program effort (experiment 1) to a system simulation (experiment 4). They are (1) Printed (white on black) versions of the candidate symbols will be evaluated experimentally on a sample of subjects using a modified paired-comparison technique to obtain discriminability indices. (2) Samples from populations of differing experiential background (e.g., pilots familiar with other symbology, fighter-bomber pilots, and non-military subjects) will be required to construct symbols representing tactical intelligence events, objects or conditions. The most common symbols will be selected for further evaluation. (3) The candidate symbol sets generated via (1) and (2) above will be tested further in an experiment in which the time required to establish associations between symbols and objects, events, or conditions will be obtained. (4) A part-task JTIDS mission simulation will be developed and used to test the compatibility of JTIDS task demands with other pilot tasks.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0016, ONE-ON-ONE G/A ENGAGEMENT MODEL DEVELOPMENT

W.C. Summers, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF322490)

Develop a ground-to-air attrition model for the soviet ZSU-23-4 antiaircraft artillery weapon system. This model will include an optimal control azimuth and elevation human operator submodel, an optimal control radar range human operator submodel, a model of crew discrete decisions including mode switching, an optimal control model of engagement tracking with tracers, and a model of the target acquisition process.

Evaluate exploitation documents, existing software, software under development (e.g., B.D.M. software) and field test data. Extract weapon subsystem descriptions and estimates of their inherent weapon system modelling errors. Develop software which predicts the performance of the ZSU-23-4 AAA weapon system with minimal error while maintaining run times compatible with large data base reduction on the CDC 6600 and comparable computers. Integrate human operator tracker models as completed under other 689304 work units.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0017, M&O IN SPT OF RESEARCH ON TRACKING PERFORMANCE IN MOIFE

G.T. Collins, University of Dayton, Research Inst., *300 College Park Ave., Dayton, Ohio* 45469 (DF322520; F33615-76-C-0401)

Effects of chronic and acute exposure of humans to vibration stress are not sufficiently well understood to permit optimal weapon system design. The primary goal of this effort is continued safe operation of the Branch's motion simulators in support of in-house research. Emphasis on in-house control of experiments with human subjects dictates that protocols and interpretation of reduced data be controlled by Air Force personnel. Additional research is therefore aimed at obtaining support in carrying out approved protocols, obtaining data, and improvement or modification of simulators to give special environmental simulation.

The contractor will (1) establish and/or maintain safe operational procedures for all Branch motion simulators and power supplies in operational status, (2) provide continuing operational and engineering support for said simulators and power supplies, (3) provide research into special instrumentation required for experiments carried out on said simulators, (4) provide data collection, reduction and analysis support for experiments carried out on said simulators, (5) provide research required to modify said simulators, their power supplies or their control systems when special environmental simulation is foreseen, (6) provide orientation in operation and maintenance of Branch motion simulators to otherwise qualified newly assigned in-house personnel. This work unit represents that 50 percent of contract F 33615-76-C-0401 which will be devoted to 'support of research on tracking performance in Multiaxis Oscillating Inertial Force Environment (MOIFE).' The other 50 percent of the contract is documented under 72310170, 'Support of Research on Visual Performance in Multiaxis Oscillating Inertial Force Environments (MOIFE).'

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0018, EFFECTS OF COMBINED STRESSES ON NAVAL AIRCREW PERFORMANCE

J. Bowman, U.S. Dept. of Defense, Navy, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate, *Warminster, Pennsylvania* 18974 (DN233054)

To study the effects of combined stresses on aircrew performance and fatigue under dynamic conditions simulating the operational environments of fighter/attack, patrol/support, and helicopter aircraft, in order to improve crew proficiency and safety of flight operations, to quantify the extent to which each stress contributes to total fatigue, and to define the actual mechanisms by which these stresses affect the aircrews. Requirements for this work are included in the FY 1974 Naval Aviation Biomedicine/Human Effectiveness Report.

Performance and biomedical/physiological data are collected from trained human subjects performing simulated aircrew tasks, while exposed to combinations of aviation-related stressors. The independent variables include: acceleration, vibration (buffet), noise, intracockpit temperature, seatback angle, g protective devices, and mobility and visual restrictions imposed by flight gear. In addition to studying deleterious effects of the stressors, effects of protective devices are measured, with respect to improving man's capabilities. The NAVAIRDEVCEN dynamic flight simulator will be used to provide realistic simulations of present and future aircraft eenvironmnts.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

6.0019, PHYSIOLOGICAL CRITERIA FOR ASSESSMENT OF NAVAL AIRCREW PROTECTIVE EQUIPMENT

M.M. Cohen, U.S. Dept. of Defense, Navy, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate, *Warminster, Pennsylvania* 18974 (DN581100)

To establish appropriate physiological, behavioral, and biomedical specifications and criteria for the design, development, testing, and evaluation of protective and survival aircrew equipment. Requirements for this work have been delineated in the Naval Aviation Biomedicine/Human Effectiveness Technical Workshop Report of FY1974.

Existing data concerning the adequacy and safety of protective equipment are reviewed and complemented by in-house research studies. Physiological, behavioral, and biomedical specifications and criteria for the design and development of future life support and protective equipment are established. Medical and scientific assistance is provided to establish test protocol and safety procedures for the evaluation of prototype protective equipment. This assistance includes medical monitoring of volunteer human subjects, pre- and post-test medical examinations, medical and psychophysiological evaluations of test results, and, where applicable, suggestions for subsequent improvement of the biomedical and psychophysiological adequacy of systems.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Medical Research Inst.

6.0020, MAINTENANCE OF AIR FORCE HUMAN RESOURCES DATA BASE (CONTINUATION)

C.C. Fresne, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Brooks Air Force Base, San Antonio, Texas* 78235 (DF232750)

Continuation of 63230101 - to collect, document, maintain, and update automated personnel data for Air Force officers, enlisted personnel, and the civilian work force. To organize these data in readily accessible data bases for support of research studies of the personnel system.

Automated standard and command-unique personnel data files will be acquired, edited, and reformatted. Data for all military accessions, flying and technical training, reenlistment and separations, and strength files will be included. Nonautomated documents containing performance and evaluation data will be acquired and converted to machine-compatible form. Milestones - Apr 78 & annually, complete CY 77 update of basic military training file. Apr 78 & annually, complete processing of Dec 77 UAR/UOR active. May 78 & annually, complete processing of FY 77 navigator detailed history file. Jun 78 & annually, complete CY 77 preparation of AFOQT data. Aug 78 & annually, revalidate requirements for continuing receipt of approximately 30 source files including UAR/UOR active (tri-annually), UAR/UOR reserve/ang (annually), technical training (quarterly), basic military training and OTS (monthly), flying/navigator training (annually), etc. Oct 78 & annually, complete processing of Jun 78 UAR/UOR active files. Dec 78 & annually, complete processing of Sep 78 UAR/UOR ANG/reserve files. Jan 79 & annually, complete processing of Sep 78 UAR/UOR active files. Feb 79, complete processing of Sep 78 AFROTS applicants/advanced/commissioned losses files. Mar 79, complete processing of CY 78 technical training file.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0021, SUPPORT TO OTHER DOD & US GOVERNMENT AGENCIES AND CIVILIAN ORGANIZATIONS
J.A. Boydstun, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF322010)

The objective of this work unit is to provide direct support to requestors for assistance through utilization of the existing aerospace medicine technology data base, the expertise of the Clinical Sciences Division staff, and where required, the expertise of USAFSAM resources outside of Clinical Sciences Division.

The approach to be utilized will involve initial Division staffing of the specific request to determine the full spectrum and scope of the endeavor, the individuals to participate in the evaluation, and the assignment of OPR to a specific Clinical Sciences Division scientist. All available Division resources will be subject to utilization at one time or another including the various medical information files, the accumulated patient evaluation records from the Aeromedical Consultation Service, and also the accumulated years of aeromedical experience and judgment. Anticipated products will be summary of evaluations and analyses which may be in a simple letter reply, a USAFSAM Technical Report, or published paper. This is a new start work unit for FY 77.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0022, PAVE LOW CREW FATIGUE
P.J. Dowd, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF324230)

The PAVE LOW III system was developed in response to MAC ROX 19-70 which established the requirement for a low level/adverse weather combat rescue mission. Pave low III consists of a terrain following radar, forward looking infrared (FLIR) sensor, inertial navigation system, Doppler radar set, and projected map display (PMD) integrated through a central avionics computer into a night recovery system equipped HH-53 helicopter. The results of DT&E and IOT&E indicated that the demands of the system coupled with the increased mission profile for which Pave Low was developed could impose high levels of fatigue and stress on the aircrew. The evaluation of crew fatigue and psychophysiologic stress during Pave Low missions will: (a) identify and analyze psychophysiologic stresses associated with the missions, (b) determine maximum flying time and crew duty day limitations, (c) determine predeparture and postmission crew rest requirements, (d) determine mimimum recovery period for repetitive missions, (e) evaluate crew performance, and (f) evaluate safety factors.

The SAM battery of psychophysiologic measures will be used, consisting of self ratings of subjective fatigue, sleep surveys, oral temperature, and endocrine/metabolic indices derived from analysis of urine samples. These measures collected before and after each mission, also during nonflying intervals providing 3-4 days of baseline data.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0023, ANALYTICAL METHODS FOR ENVIRONMENTAL ASSESSMENT OF VOLATILE NITROSAMINES
W.W. Lackey, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF320880)

This work unit will develop, test and evaluate sorbent and extractive sampling methods for detection and quantitative measurement of n-nitrosodimethylamine (NDMA) in ambient air, soil and water media. NDMA is an intermediate in the industrial synthesis of unsymmetrical dimethylhydrazine (UDMH) rocket fuels, and is one of the carcinogenic compounds controlled by OSHA. This development effort is essential to provide cost-effective sampling/analysis procedures to ensure environmental safety of continued UDMH production. This effort supports the AFLC (SAALC/SF) procurement of UDMH rocket fuel. This effort previously documented under 7164-16-27.

Cold-trap, impinger and sorbent tube NDMA-sample collection methods will be compared against various analytical procedures including wet chemistry, chromatography, and chemiluminescence (thermal energy analysis) to establish an artefact-free referee method for air, water and soil media. Standardized sampling methods will be transitioned to the Air Force Occupational and Environmental Health Laboratory (OEHL) for routine air monitoring in FY 77, and for routine soil/water monitoring in FY 78.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0024, FEASIBILITY EVALUATION OF SIX-MAN OPEN LOOP OXYGEN GENERATION SYSTEMS (OLOGS)
L.J. Luskus, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF322240)

To test for human compatibility for fluomine on-board oxygen generating system.

Flight prototype fluomine oxygen generator systems will be tested for contaminant off-gassing and human physiologic compatibility under simulated flight profiles.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0025, INFLIGHT PHYSIOLOGICAL MONITORING/LIFE SUPPORT EQUIPMENT TESTING
J.T. Merrifield, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF319810)

There is currently a need to reassess life support system design criteria and investigate specific biomedical hazards of flight. To measure aircrew physiological response in actual flight environments is essential to this effort. Information is needed which will permit derivation of future breathing system design criteria, oxygen generation/storage requirements, facilitate inflight testing and evaluation of life support equipment, and provide an index of aircrew workload/stress in representative flying roles. Previous accomplishments in this area are documented under work unit 79301109.

An inflight physiological data acquisition system (IFPDAS), providing magnetic tape record of selected environmental and physiological data, has been developed. The system consists of an instrumented oxygen mask and associated sensor/signal conditioning/recorder circuitry, of sufficiently small size and weight to permit its installation in selected pockets of the crewmember's survival vest, or any easily accessible cockpit space. Data collected include pulmonary ventilation, inspired/expired oxygen concentration, ECG, GZ, cabin pressure, and voice.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0026, VISUAL STANDARDS
T.J. Tredici, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF321770)

Aircrew must be able to maintain continuity of vision in their operation of manned aerospace vehicles. Review and update of the visual standards for entry and retention in the flying specialties is essential to insure visually qualified members in sufficient numbers capable of performing the mission.

Liaison with the Army and Navy on visual standards for aircrew will be maintained, and coordination with FAA on standards for category classifications of commercial pilots will be on a continuous basis. Dynamic stress effects on the visual system will be investigated. Ocular aging will be studied to assure proper physical standards criteria, therapy, and/or prevention. Efforts previously under work unit 7755-09-04.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Com-

puter Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, ALGORITHMS FOR EFFICIENT MATRIX COMPUTATION

J. DePillis, University of California, Riverside Campus, Graduate School, Dept. of Mathematics, *Riverside, California* 92502 (DF041360; AFOSR-75-2858)

AF function - the study of the effects of nuclear detonation on aerospace vehicles, permanent structures and equipment. Deficiency - the numerical solution of the PDE's arising in these studies require large numbers of matrix multiplications which are very expensive on computer time. Objective - this research intends to develop fast matrix multiplication algorithms and techniques for the efficient solution of linear systems. How work contributes - this research may generate algorithms and techniques which can be implemented into effective computer codes to reduce substantially the cost of computation.

This effort intends to develop fast algorithms and techniques for (1) reducing the number of scalar multiplications required to multiply rectangular matrices together, (2) solving a system of linear equations. In this area if a sequence of values obtained iteratively by a classical two-part splitting like Gauss-Seidel or SOR technique diverges, this sequence can be converted under certain conditions into a convergent sequence. If the original sequence converges then, under certain conditions, such convergence can be accelerated. Cases in which the linear system is sparse or singular will be investigated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0002, NUMERICAL ANALYSIS ISSUES IN LINEAR ALGEBRA

S.F. McCormick, Colorado State University, School of Natural Sciences, Dept. of Mathematics & Computer Science, *Fort Collins, Colorado* 80523 (DF138700; AFOSR-76-3019)

Large-scale structural analysis computer programs are basic tools in the design of weapons, airlift, and delivery systems. A basic component of these programs is an algorithm for the solution of large, sparse generalized eigenvalue problems. In typical applications the factorization of the component sparse matrices is not feasible because of size limitations of the central memory of the large computers. Few methods for the partial solution of the generalized eigenproblem apply in these situations. Moreover, almost all of the current methods are severely impaired when eigenvalue clustering occurs. The goals of the investigation are to develop, analyze, implement, and test potentially efficient numerical methods for solving the generalized eigenproblem in such a way that the algorithms are suitable for inclusion in the large-scale structural analysis programs.

Particular emphasis will be placed on a new approach which promises to desensitize the techniques from eigenvalue clustering. Of special importance will be tests conducted using the methods developed under this effort and comparing them with results obtained using the methods currently in use.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

7.0003, SOME ALGORITHMIC PROBLEMS IN LINEAR SYSTEMS

A.G. Lindquist, University of Kentucky, College of Arts & Sciences, Dept. of Mathematics, *Limestone & Euclid, Lexington, Kentucky* 40506 (DF050650; AFOSR-78-3519)

AF function - the design of control systems for high-performance aircraft. Deficiency - the design of a linear control system is indeed a straightforward task. However, the design of a nonlinear system which has parameter uncertainty in addition to operation over diverse flight regimes is by no means simplistic and no effective means is available to do this task. Objective - the objective of this research program to develop a system of reduced order equations which can be used to construct methods which are invariant under different choices of stochastic realization, while retaining the convenient Kalman-Bucy recursions. How work contributes - success here would reduce the overall design time in control system implementation.

Research will proceed in four areas. First, the reduced order equations will be investigated to determine if the theory of invariant directions applies. The impetus will be to reduce the number of equations further. Second, a spectral factorization method and the reduced order algorithm will be applied to the stochastic realization problem. Third, an investigation will be pursued of whether the canonical transformation in Hamiltonian systems as applied to the matrix Riccati equation can be utilized on the reduced order algorithm. Finally, the relations between the reduced order algorithms and stability of time-invariant linear systems will be pursued.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0004, METHODOLOGY FOR NONLINEAR MODELS OF NAVAL SYSTEMS

R.K. Mehra, Scientific Systems Inc., *5 Angier Rd., Lexington, Massachusetts* 02173 (DN775020; N00014-76-C-1024)

Many naval problems including aircraft at high angle of attack are represented mathematically by nonlinear systems. Presently the mathematical techniques for addressing such problems are specialized and inadequate. This task will develop new methodology for nonlinear systems particularly for use in the control and identification.

New approaches to treating nonlinear systems will be considered. In particular, the recently developed catastrophe theory will be investigated to determine its impact for applications in control and identification.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

7.0005, OPTIMAL AIRCRAFT DESIGN METHODS

R.B. Ram, State University of New York, College at Oneonta, School of Arts & Sciences, Dept. of Mathematics, *Oneonta, New York* 13820 (DF052280; AFOSR-78-3615)

AF function - to advance the design of technologically superior and cost-effective military aircraft. Deficiency - the large number of sensitive parameters and of conflicting requirements results in enormously complicated and time-consuming calculations. Objective - to investigate the advantages of statistical designs of experiments in the area of aircraft design. How work contributes - success in this research would mean much better and more cost-effective aircraft with less computation in the future.

The most appropriate experimental designs for the cited purpose were found to be the d-optimal designs. The plan is to conduct analytical and applications-oriented studies of such designs.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0006, STATISTICAL ANALYSIS OF FLIGHT RECORDER DATA

D. White, Vought Corp., *P.O. Box 5907, Dallas, Texas* 75222 (DN790085; N00019-77-C-0464)

Investigate the existence of statistical relationships among measured flight parameters and flight stress spectra to allow more effective monitoring of aircraft structural life expenditure.

Analysis of multichannel flight data, containing measurements of flight parameters and strain at multiple airframe locations.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, COMMUNICATIONS - RADIATION AND RELATED PROCESSES IN PLASMAS AND THEIR ROLE IN SOLAR ACTIVITY

P.A. Sturrock, Stanford University, School of Humanities & Sciences, Dept. of Physics, *Stanford, California* 94305 (DN123312; N00014-75-C-0673)

The X-ray and EUV flux emitted by solar flares cause sudden ionospheric disturbances that disrupt naval communications and navigation systems. The objective of this research is to develop an improved understanding of the physical processes that lead to flares, which may lead to improved flare predictions.

Theoretical research is performed on pre-flare activity, on magnetic-field instability and particle acceleration, and on EUV and X-ray radiation during the impulsive and decay phases of a flare. The results are compared with available experimental data.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0002, RADIATION AND LASER POTENTIAL OF HOMO- AND HETERO-NUCLEAR RARE GAS DIATOMIC MOLECULES

W.C. Walker, University of California, Santa Barbara Campus, School of Letters & Science, Dept. of Physics, *Santa Barbara, California* 93106 (DF046700; AFOSR-77-3137)

AF function - upper atmosphere effects on Air Force operations and advanced short-wavelength lasers. Deficiency - there is insufficient knowledge available of the spectroscopic properties of rare gas continua which occurs in the vacuum ultraviolet region of the spectrum. Objective - study spectroscopically the electronic, vibrational and rotational structures of homo- and hetero-nuclear rare gas dimers and excimers. Determine accurate, molecular constants and potential energy curves for the ground and excited states. How work contributes - low lying electronic states of homo- and hetero-nuclear rare gas diatomic molecules are of intrinsic importance in understanding long-range forces. In addition, these molecules are also of interest because they are a source of intense vacuum ultraviolet (VUV) radiation and are candidates for VUV laser systems.

For the purpose of studying the homo- and hetero-nuclear rare gas diatomics and rare gas halide and oxide excimers high-resolution spectroscopic methods will be employed. Studies will include emission and absorption spectroscopy in the visible near and vacuum ultraviolet regions. Pressure dependence of excimer emission will be determined and radiative lifetimes of important excimer emission bands using pulsed UV synchrotron radiation are planned for measurement.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0003, LONG DURATION EXPOSURE FACILITY (HEAVY IONS IN SPACE)

M.M. Shapiro, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN880028)

To investigate the nature and properties of various components of HZE (high charge and energy) particle radiation in space. A better knowledge of the composition, intensity and energy spectra of HZE particles is necessary in order to evaluate their potential radiation damage to men and materials in space.

Passive plastic track detectors will be exposed to space radiations aboard NASA's LDEF (long duration exposure facility). Heavy ion beams at the LBL Bevalac accelerator will be used to calibrate the detectors. The experimental results will form the basis for follow-up experiments proposed for the space shuttle program.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

8.0004, HIGH-TEMPERATURE PLASMAS - INTENSE ION BEAMS

H.R. Griem, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (DN780195; N00014-75-C-0309)

Theoretical and numerical investigations are performed on the dynamics and stability of high-temperature plasmas and charged particle beams. Areas of particular concern are the generation and manipulation of intense relativistic electron beams, intense ion beams, laser-plasma interaction and plasma spectroscopy.

This program involves theoretical studies of (a) the equilibrium, stability and transport properties of intense ion beams and relativistic electron beams, (b) nonlinear effects, as they pertain to microstability behavior and anomalous transport in high-temperature plasmas, and (c) studies of radiation processes and atomic excitations by electron collisions.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

8.0005, MAGNETIC HYPERFINE INTERACTIONS IN SOLIDS

G.R. Hoy, Boston University, School of Arts & Sciences, Dept. of Physics, *881 Commonwealth Ave., Boston, Massachusetts* 02215 (DMR7719017A01)

The magnetic hyperfine interactions will be used to investigate magnetic interactions in solids. A model to explain the puzzlingly large negative, as well as positive, hyperfine fields at nonmagnetic impurities in magnetic hosts will be tested experimentally by determining the charge and spin density oscillations around and at the impurity site. Mossbauer investigations on magnetic hyperfine interactions in metals and paramagnetic salts at temperatures well below 4K will be carried out, using a He3-He4 dilution refrigerator. Recent results for Y (FeO.02Co0.98)2 indicate the existence of relaxation effects in this metal at very low temperatures. Furthermore, at these ultra-low temperatures, fundamental aspects of the Hamiltonian which describe the magnetic hyperfine interactions of a ferric ion in a 6S5/2 state can be investigated. The development of, and experiments with, the Selective Excitation Double Mossbauer technique and with Delayed Coincidence Mossbauer Spectroscopy will be continued. In addition a new method will be used which combines the Time Delayed Perturbed Angular Correlation technique with the Mossbauer Effect and will make possible the determination of the sign of the electric-field gradient at a nuclear site even in the case of polycrystalline materials.

First year of a three-year continuing grant. This is a continuation of research supported by DMR7307665.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0006, IMPURITY EFFECTS IN AMORPHOUS SEMICONDUCTORS 14454-P

W. Paul, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Engineering & Applied Physics, *Cambridge Station, Cambridge, Massachusetts* 02138 (DA0F8925; DAAG29 77 G0059)

To determine the transport properties, optical response and junction response characteristics of amorphous materials produced and doped by an RF sputtering technique. Relevance - if successful, this program would determine the type of new or replacement devices one could realize from elemental and binary amorphous semiconductors. The ability to fabricate useful semiconductor devices from amorphous materials would have a favorable cost impact and lead to harder types of devices.

A systematic series of experiments will be performed based on a sputtering method in which Ge, Si, GaAs and possibly other binary compounds will have their defect dangling bond densities compensated, residual non-stoichiometries corrected, and donor and acceptor states reintroduced in a controlled way. Transport properties, optical response, and junction response will be measured.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0007, PHYSICAL PROPERTIES OF DOPED AMORPHOUS SEMICONDUCTORS

J.F. Schetzina, University of North Carolina, North Carolina State University, School of Physical & Mathematical Sciences, Dept. of Physics, *Raleigh, North Carolina* 27607 (926)

The growth, characterization, and electrical and thermal properties of doped amorphous silicon and germanium films will be studied. The research grant covers installation of an RF sputtering facility which will be used to grow amorphous films to be measured with existing facilities in the Solid State Laboratory. Specific objectives are measurements of electrical and thermal transport properties as a function of hydrogenation of the films and also EXAFS studies of local structure.

SUPPORTED BY North Carolina State Government

8.0008, CHARACTERISTICS OF III-V SEMICONDUCTORS

D.C. Look, University of Dayton, School of Arts & Sciences, Dept. of Physics, *300 College Park Ave., Dayton, Ohio* 45469 (DF105310; F33615-76-C-1207)

There is a stated Air Force need for systematic evaluation and characterization of the electronic properties of the materials used in Air Force avionics systems. At present the electronic defect structure, surface and interface properties of these compound semiconductors used for microwave and opto-electronic devices are not well understood. The objectives of this contract are to identify and completely characterize the electronic defect structure of epitaxial and substrate compound semiconductors used in opto-electronic and microwave devices and to investigate the electronic properties associated with the surfaces and interfaces of the materials. Ultimate goal is to solve the material problems that affect the performance of the solid-state devices by conducting a thorough characterization study of materials, processes, and devices.

The objectives of this on-site contractual program will be accomplished by gaining information regarding defect structure of the materials. Shallow or deep impurities and defects will be probed and identified by high-resolution bandgap photoluminescence, near and/or far infrared spectroscopy, and electrical transport measurements. Electron bombardment will be employed to identify intrinsic point lattice defects. The physical position of the traps with respect to the surface or interface will be deduced from c-v measurements, and the trap depth distribution is to be determined by c-v, thermally stimulated conduction (TSC) and thermally stimulated luminescence (TSL) measurements, as applicable for different samples. Spatially resolved photoluminescence and X-ray topographic observations will be used to assist in determining the homogeneity of large samples. The results will be compared with electron irradiated and ion implanted materials.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Avionics Lab.

8.0009, SPECTROSCOPY OF MAGNETICALLY ORDERED MATERIALS

W.M. Yen, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Physics, *500 Lincoln Dr., Madison, Wisconsin* 53706 (DMR7820070)

Laser spectroscopic techniques will be applied to the study of dynamical optical properties of optically active ions in solids. These techniques include high-sensitivity modulated laser spectroscopy and fluorescence line-narrowing spectroscopy of ion systems using laser excitation. These studies will be undertaken to obtain an understanding of the relaxation and energy transport properties in crystalline solids, particularly those which show magnetic effects. New emphasis will be placed on understanding the excitonic properties of disordered systems. Coherent excitonic effects in magnetic systems will be investigated.

This is a continuation of research previously supported under DMR 7621574 and is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0010, INVESTIGATION OF FAST ION TRANSPORT IN SOLIDS USING CONDUCTIVITY AND NMR

A.V. Chadwick, University of Kent, *Canterbury, England, United Kingdom* (DF049790; AFOSR-77-3427)

AF function - power generation and distribution is required for the operation of the electrical equipment for increasing in-flight speed and performance. Deficiency - need for information of the basic mechanisms of solid electrolyte type materials used in battery and fuel cell technology. Objective - to develop fundamental information about the basic mechanisms of ionic transport, the point defect structure and self-diffusion parameters in solid-state electrolyte materials. How work contributes - results will provide important basic information on fast fluoride ion diffusion, and increase the potential for discovery of new fast ion conductors. Application of devices using these materials will provide advantages of longer working temperature range, long 'shelf-life', and easy miniaturization.

Conductivity-NMR techniques as to be employed to study ionic transport in three types of fluorides which exhibit fast ion conduction. The three types of materials are described as rare-earth fluorides, tysonite-related fluorides, and mixed fluorides. Through the application of various techniques, the following data will be obtained - accurate diffusion parameters for the constituent ions, identification of the mechanisms of diffusion, information on the point defect structures, and the relevance of the phase transitions and their effect on ionic transport. The results and interpretations will be particularly relevant in solid-state technology and in ion transport in high-temperature insulating materials.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, AN ANALYSIS OF THE ABUNDANCE OF SODIUM, NITROGEN AND OTHER ELEMENTS IN METAL-POOR DWARF AND GIANT STARS

R. Peterson, (No Performing Organization Reported), *California* (AST7618890 A01)

This research will be devoted to an analysis of the heavy element abundances in stars which are known to be deficient in heavy elements as compared to abundances in the sun. The stars to be observed will have spectral characteristics which will enable the relative abundance of either sodium or nitrogen to be determined. Current theories of the nucleosynthesis of the chemical elements have postulated that in stars where the heavy elements are generally deficient, sodium and nitrogen are expected to be exceptionally deficient. To demonstrate this for sodium would conclusively establish explosive nucleosynthesis as the mechanism which produced the heavy elements in metal-poor stars. Furthermore, the over-deficiency of sodium can be compared with the overall abundance level of the heavy elements. The correlation that may exist should be a direct measure of the completeness of mixing of the material ejected by stars with the gas between stars during the early history of our Galaxy. The question of whether the element nitrogen was produced by explosive nucleosynthesis will be answered by determining the relative abundances of sodium and nitrogen. These analyses will also yield the relative abundances of other elements synthesized in the interiors of stars.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0002, THE STABILITY OF ROTATING STARS AND GALAXIES

R.H. Durisen, Indiana University, Bloomington Campus, School of Arts & Sciences, Dept. of Astronomy, *Memorial Hall, Bloomington, Indiana* 47401 (AST7821449)

This project will involve analytical and numerical studies of instabilities in rotating stars and galaxies. For these studies, rotating stars and galaxies will be represented by the axisymmetric

equilibrium states of rotating, self-gravitating fluids. Emphasis will be placed on the global nonaxisymmetric instabilities which lead to barlike distortions or to fission into two or more fragments. The application of a variety of techniques will permit investigation of both linear and nonlinear regimes of instability. This will improve our understanding of both the conditions under which these instabilities arise and their ultimate effect on a star or galaxy. The results will have implications for a wide variety of astrophysical problems, including the formation of close binary systems, gravitational radiation and fission of a collapsing stellar core prior to a supernova event, and mass limits for rotating compact stars such as white dwarfs or neutron stars.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0003, 1. STUDIES OF COMET MOTIONS - 2. IAU AND CBAT SUBSCRIPTIONS

B. Marsden, Smithsonian Institution, Astrophysical Observatory, *60 Garden St., Cambridge, Massachusetts* 02138

Computer time to continue studies of non-gravitational forces on comets and to pursue the scientific side of the affairs of the Central Telegram Bureau. Computer time and administration of Bureau.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0004, RADIO ASTRONOMY

F.T. Haddock, University of Michigan, Ann Arbor Campus, School of Literature Science & the Arts, Dept. of Radio Astronomy, *Ann Arbor, Michigan* 48104 (AST7824192)

The emphasis of the observing program is on obtaining and analyzing multifrequency linear and circular polarization and flux density measurements of extragalactic objects (quasars, BL Lac type objects, Seyfert galaxies, etc.) at 4.8, 8.0 and 14.5 GHz. Flux density measurements, since 1965, will be continued to determine source flux density and polarization variability with time and frequency. There are improvements which give higher radiometer sensitivities at 4.8 and 8.0 GHz, full automation of the telescope controls, on on-line data reduction.

The study of the relationship of source linear polarization variations to their radio flux densities variations and to their structures as reported by VLBI observers will be continued. There will be emphasis on investigating the relationships between the polarization and flux densities at optical, infrared and radio wavelengths. Theoretical work will continue on expanding synchrotron-source models which include prolonged particle injection and non-homogeneous particle density distributions.

The search will continue for additional isolated polarized outbursts. The extragalactic variable 0235 plus 164 exhibited a large linear change in polarization position angle with time; a behavior similar to that observed in pulsars and provides evidence for a physical rotation in the source-emitting region.

Dual-frequency measurements will be continued to obtain circularly polarized emission spectra. Measurements of circular polarization at 4.8 GHz have begun. Linear and circular polarization measurements comined with simultaneous flux density observations are central to the study of galaxies and quasars. This is a continuation of AST-7624638A01.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0005, THEORETICAL STUDY OF THE JOVIAN MAGNETOSPHERE

T.W. Hill, Rice University, School of Engineering, Dept. of Space Physics & Astronomy, *6100 Main St., Houston, Texas* 77001 (ATM7821767)

This grant continues theoretical investigations of rotation-dominated phenomena in the Jovian magnetosphere. These investigations will concentrate on two specific problems: (1) the degree to which Jupiter's ionosphere is capable of enforcing rigid corotation in the outer magnetosphere, and (2) the effects of longitudinal asymmetries in Jupiter's ionosphere in producing ten-hour rotational periodicities in observed particle and radio emissions. It is intended to develop quantitative models of these ionosphere-magnetosphere interactions that can be compared directly with future observations in the Jovian magnetosphere. Such comparisons may enable us to apply our knowledge of the Jovian magnetosphere to the theoretical study of other rotating magnetospheres in astrophysics.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

GENERAL

11.0001, UNIVERSE IN MINIATURE (THE HISTORY OF PLANETARIA)

S.A. Bedini, Smithsonian Institution, *1000 Jefferson Dr. S.W., Washington, District of Columbia* 20560

A book-length history of mechanical planetaria tracing their development from the instruments traditionally ascribed to Archimedes and Posidonius, including early examples produced in the countries of the Orient, and transmissal of the concept through the Arabic culture. The subject will be integrated with a chronological study of equatoria, planispheres, astrolabes, clockwork-operated globes, armillary spheres and astronomical clocks are related instruments, followed by a detailed history of mechanical planetaria in the 15th through the mid-19th Centuries. Special consideration is given to the orrery as a refinement of the concept of mechanical cosmology. Materials for this study, which is the first such history to be attempted, are derived from contemporary documents, many of which are unpublished, surviving instruments, and a few published sources.

SUPPORTED BY Smithsonian Institution, Museum of History & Technology

11.0002, TO FLY

T.D. Crouch, Smithsonian Institution, Dept. of Astronautics, *1000 Jefferson Dr. S.W., Washington, District of Columbia* 20560

Project will result in a paper on the early roots of aerostatics, aerodynamics, and rocketry to be presented as the lead-off paper in a symposium offered by UCLA this fall. My paper is to be presented on October 2. The focus is on the scientific background for the key technical innovations leading to successful manned flight. The period covered is roughly 1000 A. D. - 1700 A. D.

SUPPORTED BY Smithsonian Institution, National Air & Space Museum

11.0003, PUBLICATION - AIRCRAFT IN MUSEUMS AROUND THE WORLD

R.C. Mikesh, Smithsonian Institution, National Air & Space Museum, *1000 Jefferson Dr. S.W., Washington, District of Columbia* 20560

This listing of aircraft in museums is directed toward making greater use of actual specimens for technical and historical research purposes. It is for this exchange of information and specimens that this contains primarily aircraft in museums, though we are aware that many other historical and unique aircraft survive throughout the world.

Periodically, this automatic data process list is updated for information submitted by museums and published for their use.

The 3rd Edition of Aircraft in Museums Around the World was completed and distributed in November 1975. The 4th edition will be completed and distributed in November 1977.

SUPPORTED BY Smithsonian Institution, National Air & Space Museum

VOLUME 17 NUMBER 16 / AUGUST 23, 1979

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERONAUTICS (GENERAL)

N79-24950* National Aeronautics and Space Administration, Washington, D. C.
AERONAUTICAL ENGINEERING: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 109
May 1979 136 p
(NASA-SP-7037(109)) Avail: NTIS HC A02 CSCL 01A

This bibliography lists 466 reports, articles, and other documents introduced into the NASA scientific and technical information system in April 1979. Author

N79-24951*# National Aeronautics and Space Administration, Washington, D. C.
ADVANCED ROTORCRAFT TECHNOLOGY: TASK FORCE REPORT
15 Oct. 1978 189 p
(NASA-TM-80541) Avail: NTIS HC A09/MF A01 CSCL 02A

The technological needs and opportunities related to future civil and military rotorcraft were determined and a program plan for NASA research which was responsive to the needs and opportunities was prepared. In general, the program plan places the primary emphasis on design methodology where the development and verification of analytical methods is built upon a sound data base. The four advanced rotorcraft technology elements identified are aerodynamics and structures, flight control and avionic systems, propulsion, and vehicle configurations. Estimates of the total funding levels that would be required to support the proposed program plan are included. A.R.H.

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N79-24952 Stanford Univ., Calif.
RESONANCE REFRACTIVITY STUDIES OF SODIUM VAPOR FOR ENHANCED FLOW VISUALIZATION Ph.D. Thesis
Gerhard Werner Blendstrup 1979 149 p
Avail: Univ. Microfilms Order No. 7912343

The refractivity of sodium near its atomic resonances at 5890 A was measured in order to obtain sensitivities of refractive phenomena used in flow visualization techniques. A double heat pipe oven, a Mach-Zehnder interferometer, and a nitrogen-pumped tunable dye laser in Haensch configuration were used to calibrate the rensonant dispersion. The ultimate maximum enhancement obtainable in the case of pure sodium was found to be determined by absorption considerations which limit the closest proximity to line center to which the dye laser can be tuned before virtually complete absorption of the light beam takes place. An enhancement in refractive index of over three orders of magnitude compared to the non-resonant refractivity of air was achieved. Dissert. Abstr.

N79-24953 Minnesota Univ., Minneapolis.
FLUCTUATING PRESSURE FIELD ON A YAWED RIGID CYLINDER Ph.D. Thesis
Michael Jay Sax 1978 177 p
Avail: Univ. Microfilms Order No. 7912075

The second order statistics of the dynamic response of a yawed circular cylinder are calculated when the axial and circumferential spatial dependence and the time delay dependence of the two-point cross correlation field of the surface pressure distribution are known. The results of an experimental program to measure these quantities on a yawed rigid cylinder subjected to three weakly stationary turbulent flow environments which had different values of the intensity and length scales of the turbulence are discussed. When the cylinder was placed in these flow environments the flow around the cylinder was subcritical for two flow environments and supercritical for the third. For both types of pressure response a parametric description of the experimentally measured complete two-point cross correlation field was determined and the variation of the parameters with changes in the angle of yaw of the cylinder are presented. Dissert. Abstr.

N79-24954 Iowa Univ., Iowa City.
THICK AXISYMMETRIC TURBULENT BOUNDARY LAYER AND WAKE OF A LOW-DRAG BODY Ph.D. Thesis
Yu-Tai Lee 1978 133 p
Avail: Univ. Microfilms Order No. 7912877

Measurements of pressure distributions, mean velocity profiles and Reynolds stresses were made in the thick, axisymmetric boundary layer and the near wake of low-drag body of revolution. These measurements shed some light on the joint influence of transverse and longitudinal surface curvatures and pressure gradients on the boundary-layer development and on the manner in which an axisymmetric boundary layer becomes a developed wake. The present data was used to provide an independent check on the accuracy of the simple integral method. Calculations were performed using the differential equations of the thick axisymmetric turbulent boundary layer and a rate equation for the Reynolds stress derived from the turbulent kinetic energy equation along the lines suggested by Bradshaw and others. It is shown that the boundary layer in the tail region of a body of revolution is dominated by the extra strain rates arising from longitudinal and transverse surface curvatures. Dissert. Abstr.

N79-24955*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
STATUS OF KNOWLEDGE OF SONIC BOOMS
Domenic J. Maglieri, Harry W. Carlson, and Harvey H. Hubbard Jun. 1979 20 p refs Presented at the 97th Tech. Meeting of the Acoustical Soc. of America, Cambridge, Mass., 12-16 Jun. 1979
(NASA-TM-80113) Avail: NTIS HC A02/MF A01

CSCL 01A

The status of sonic boom technology with emphasis on the recent research results is summarized. Included are definitions of the boom carpets, both primary and secondary, a discussion of existing experience with primary booms including the status of overpressure predictions and boom minimization methodology through airplane design, an indication of the boom waveforms and audibility, and a discussion of focus booms resulting from aircraft maneuvers as well as the effect of abnormal atmospheric conditions on these maneuver booms. M.M.M.

N79-24956*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A VECTOR-CONTINUOUS LOADING CONCEPT FOR AERODYNAMIC PANEL METHODS
William B. Kemp, Jr. May 1979 39 p refs
(NASA-TM-80104) HC A03/MF A01 CSCL 01A

An approach to the reduction of discretization errors in aerodynamic panel methods is presented. The approach is based on preventing the occurence of induced velocity singularities at panel slope discontinuities by maintaining continuity of the velocity jump vector across the panels. The approach was implemented in a two-dimensional incompressible panel method formulation and evaluated by application to several external and internal flow problems. The method is shown to exhibit a second order accuracy trend and to produce smaller errors with velocity component boundary conditions imposed on the real flow than with equipotential boundary conditions imposed on the imaginary flow behind the panels. For flows around airfoil sections with either sharp or blunt trailing edges, the method gives excellent agreement with results from a well developed finite difference method. The method is well behaved and is insensitive to irregularities in panel size distribution. S.E.S.

N79-24957*# Informatics, Inc., Palo Alto, Calif.
COMPUTATIONS OF UNSTEADY TRANSONIC FLOW GOVERNED BY THE CONSERVATIVE FULL POTENTIAL EQUATION USING AN ALTERNATING DIRECTION IMPLICIT ALGORITHM
Peter M. Goorjian Jun. 1979 48 p refs
(Contract NAS2-9891)
(NASA-CR-152274) Avail: NTIS HC A03/MF A01 CSCL 01A

A development was the time linearization of the density function. This linearization reduces the solution process from solving just a single equation. Two sample cases were computed. First, a one dimensional traveling shock wave was computed and compared with the analytic solution. Second, a two dimensional case was calculated for a flow field which resulted from a thickening and subsequently, thinning airfoil. The resulting flow field, which included a traveling shock wave, was compared to the flow field obtained from the low frequency, small disturbance, transonic equation. J.A.M.

N79-24958*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
HELICOPTER ROTOR AIRFOIL Patent Application
Gene J. Bingham, inventor (to NASA) Filed 6 Mar. 1979 21 p
(NASA-Case-LAR-12396-1; US-Patent-Appl-SN-017889) Avail: NTIS HC A02/MF A01 CSCL 01A

An airfoil which has particular application to the blade or blades of rotor aircraft and aircraft propellers is presented. The airfoil thickness distribution, camber and leading edge radius are shaped to locate the airfoil crest at a more aft position along the chord, and to increase the freestream Mach number at which sonic flow is attained at the airfoil crest. The reduced slope of the airfoil causes a reduction in velocity at the airfoil crest at lift coefficients from zero to the maximum lift coefficient. The leading edge radius is adjusted so that the maximum local Mach number at 1.25 percent chord and at the designed maximum lift coefficient is limited to about 0.48 when the Mach number normal to the leading edge is approximately 0.20. The lower surface leading edge radius is shaped so that the maximum local Mach number at the leading edge is limited to about 0.29 when the Mach number normal to the leading edge is approximately 0.20. The drag divergence Mach number associated with the airfoil is moved to a higher Mach number over a range of lift coefficients resulting in superior aircraft performance. NASA

N79-24959*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
AN ANNULAR WING Patent Application
Harold J. Walker, inventor (to NASA) Filed 30 May 1979 25 p
(NASA-Case-FRC-11007-2; US-Patent-Appl-SN-043911) Avail: NTIS HC A02/MF A01 CSCL 01A

An annular wing suitable for supporting in flight an aircraft characterized by the absence of directional stabilizer surfaces is described. The wing comprises an annular body of a substantially uniformly symmetrical configuration characterized by an annular positive lifting surface and a chord line coincident with a segment of a line radiating along the surface of an inverted truncated cone whereby a decalage is established for the leading and trailing semicircular portions of the body, relative to instantaneous line of flight, and a dihedral is established for the laterally opposed semicircular portions of the body, relative to the line of flight. The direction of flight and the climb angle or glide slope are established by selectively positioning the center of mass of the wing ahead of the aerodynamic center along a radius coincident with an axis for a selected line of flight. NASA

N79-24960*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
LOW-SPEED WIND TUNNEL RESULTS FOR A MODIFIED 13-PERCENT-THICK AIRFOIL
Robert J. McGhee and William D. Beasley May 1977 41 p refs
(NASA-TM-X-74018) Avail: NTIS HC A03/MF A01 CSCL 01A

Wind-tunnel tests were conducted to evaluate the effects on performance of modifying a 13-percent-thick low-speed airfoil. The airfoil contour was altered to reduce the aft upper surface pressure gradient and hence delay boundary layer separation at typical lift coefficients for light general aviation airplanes. The tests were conducted at a Mach number of 0.15 or less over a Reynolds number range from about 1,000,000 to 9,000,000. Author

N79-24961*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
LOW-SPEED WIND-TUNNEL INVESTIGATION OF WING FINS AS TRAILING-VORTEX-ALLEVIATION DEVICES ON A TRANSPORT AIRPLANE MODEL
Delwin R. Croom and G. Thomas Holbrook Jun. 1979 30 p refs
(NASA-TP-1453; L-12776) Avail: NTIS HC A03/MF A01 CSCL 01A

The trailing-vortex-alleviation effectiveness of both a one- and a two-fin configuration (semicircular with a radius of 0.043 semispan) on a jumbo-jet transport airplane model in its landing configuration was investigated in the Langley V/STOL tunnel, by the trailing-wing sensor technique. The fins were located on the upper surface of the transport model wing along the 30-percent-chord line. The fin configurations were effective in reducing the vortex-induced rolling moment, by amounts varying from 28 to 60 percent, on the trailing wing model located at a distance of 7.8 transport model wing spans downstream of the transport model. The flow over the fins and over the transport airplane model wing downstream of the fins was observed to be separated and turbulent. All fin configurations caused a reduction in maximum lift coefficient, a positive increment in drag coefficient, and an increment in nose-up pitching-moment coefficient on the transport airplane model. J.M.S.

N79-24962# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
EFFECT OF ANGLE ATTACK ON CAVITY FLOW OSCILLATIONS, PHASE 2 Final Report
V. Sarohia and P. F. Massier Oct. 1978 55 p refs
(Contract MIPR-R-77-25)
(AD-A066047; JPL-Pub-79-19; HDL-CR-78-025-1) Avail: NTIS HC A04/MF A01 CSCL 01/2

Separated subsonic flow over cavities of several widths and depths located on fuze-nose and ellipsoidal axisymmetric bodies have been investigated experimentally at various angles of attack

to the free-stream. The fluctuating and mean velocities and pressures inside the cavity were measured at various circumferential locations. Large circumferential variations in the root mean square pressure fluctuations were observed in the cavity at an angle of attack. The hotwire measurements of velocity fluctuations showed that the circumferential variations in cavity pressure oscillations were caused by the loss of spanwise coherency of the large-scale structures around the cavity. Visualization of the flow further confirmed that the strength of the cavity pressure fluctuations was closely related to the presence of the large-scale organized fluctuations in the cavity shear flow. GRA

N79-24963# Naval Postgraduate School, Monterey, Calif.
THEORETICAL ANALYSIS OF TRANSONIC FLOW PAST UNSTAGGERED OSCILLATING CASCADES M.S. Thesis
Peter Carlton Olsen Sep. 1978 135 p refs
(AD-A063083) Avail: NTIS HC A07/MF A01 CSCL 20/4

An independent verification of the collocation method as a technique for calculating the lift on an oscillating airfoil in an unstaggered cascade immersed in transonic flow is presented. Two formulations are shown; one is purely numerical, the second employs an analytic expansion for small frequency.Author (GRA)

N79-24964# Army Missile Research and Development Command, Redstone Arsenal, Ala. Technology Lab.
THE AERODYNAMIC CHARACTERISTICS OF THE FREE FLIGHT DEMONSTRATION ROCKET AT MACH NUMBERS FROM 0.4 TO 3.0
James A. Humphrey 22 Jan. 1979 170 p refs
(AD-A066733; DRDMI-T-79-26) Avail: NTIS HC A08/MF A01 CSCL 19/7

The Free Flight Rocket Technology Program generated a need for the Free Flight Demonstration Rocket test vehicle. This vehicle is to be used to determine the success of past efforts to improve free rocket accuracy. It will also be used as a data-gathering test bed to evaluate future improvements. As part of the Free Flight Demonstration Rocket design validation, a series of two wind tunnel tests was conducted at the Arnold Engineering Development Center to verify the predicted aerodynamic coefficients of the selected configuration. Author (GRA)

N79-24965# Boeing Aerospace Co., Seattle, Wash.
FACTORS INFLUENCING THE ACCURACY OF AERODYNAMIC HINGE-MOMENT PREDICTION Final Report, Apr. 1977 - Apr. 1978
Wen-Fan Lin and Michael D. Clarke Aug. 1978 107 p refs
(Contract F33615-76-C-3170; AF Proj. 2403)
(AD-A066606; D180-24604-1; AFFDL-TR-78-72) Avail: NTIS HC A06/MF A01 CSCL 01/3

This report is concerned with factors influencing the accuracy of aerodynamic hinge-moment analyses. The formulation and coding of the hinge-moment analysis in the FLEXSTAB system of computer programs are reviewed. The investigation is centered on the sensitivity of the hinge moments of the YF-16 airplane to paneling configuration, including the near-field/far-field techniques. The results are compared with test data. The effect of elasticity is also considered. The other existing aerodynamic methods for predicting control-surface loading are also reviewed and discussed. These methods include Datcom, RHO 4, higher order lifting-surface methods such as TEA 230 and the PAN AIR pilot program, and new theoretical approaches employing asymptotic expansion methods to account for local hinge-line, corner, and side-edge effects. Recommendations are made as to the best approach currently to employ in the panel methods, as well as future research areas related to hinge-moment analysis. Author (GRA)

N79-24966# Boeing Vertol Co., Philadelphia, Pa.
INTERACTIONAL AERODYNAMICS OF THE SINGLE ROTOR HELICOPTER CONFIGURATION. VOLUME 3B: FLOW ANGLE AND VELOCITY WAKE PROFILES IN LOW FREQUENCY BAND, AIR EJECTOR SYSTEMS AND OTHER DEVICES Final Report, 15 Mar. 1977 - 13 Feb. 1978
Philip F. Sheridan Sep. 1978 203 p
(Contract DAAJ02-77-C-0020; DA Proj. 1L2-62209-AH-76)
(AD-A061767; USARTL-TR-78-23C-Vol-3B) Avail: NTIS HC A10/MF A01 CSCL 01/3

This is the second of the two sub-volumes comprising Volume III. These documents present profiles of the RMS values of the wake flow angles and velocities in the 1 Omega to 2 Omega range. The format is waterline on the ordinate and velocity or flow angle on the abscissa. Each graph shows a comparison of the baseline flow to the flow modified by some device or condition. This sub-volume covers air ejector systems, air ejectors and hub caps in same configuration, wings, fairings and miscellaneous devices. Author (GRA)

N79-24967# Boeing Vertol Co., Philadelphia, Pa.
INTERACTIONAL AERODYNAMICS OF THE SINGLE ROTOR HELICOPTER CONFIGURATION. VOLUME 2B: HARMONIC ANALYSIS OF AIRFRAME SURFACE PRESSURE DATA, RUNS 7-14, MID SECTION Final Report, Mar. 1977 - Feb. 1978
Philip F. Sheridan Sep. 1978 219 p
(Contract DAAJ02-77-C-0020; DA Proj. 1L2-62209-AH-76)
(AD-A061860; USARTL-TR-78-23B-Vol-2B) Avail: NTIS HC A10/MF A01 CSCL 01/3

This is the second of the nine sub-volumes of Volume II. These documents contain harmonic analyses of the waveforms generated by each of the 53 pressure transducers, which covered the surface of the model fuselage and empennage. This sub-volume covers the first eight of the twenty-seven runs devoted to surface pressure testing. The analyses encompass the transducers in the middle section of the model. Test conditions and configurations include baseline data, climb and descent, disk loading variation, and application of strakes. Author (GRA)

N79-24968# Boeing Vertol Co., Philadelphia, Pa.
INTERACTIONAL AERODYNAMICS OF THE SINGLE ROTOR HELICOPTER CONFIGURATION. VOLUME 6B: ONE-THIRD OCTAVE BAND SPECTROGRAMS OF WAKE SINGLE FILM DATA, BASIC CONFIGURATION WAKE EXPLORATIONS Final Report, Mar. 1977 - Feb. 1978
Philip F. Sheridan Sep. 1978 374 p
(Contract DAAJ02-77-C-0020; DA Proj. 1L2-62209-AH-76)
(AD-A061861; USARTL-TR-78-23F-Vol-6B) Avail: NTIS HC A16/MF A01 CSCL 01/3

This is the second of the three volumes of Volume VI containing one-third octave band spectrographs of the model helicopter hub/rotor wake velocities derived from the single-film velocity transducer data. This sub-volume deals with the wake characteristics of the baseline configuration. Author (GRA)

N79-24969# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Flugzeuge-Entwicklung.
FINITE VOLUME METHOD FOR THE COMPUTATION OF TRANSONIC POTENTIAL FLOWS PAST WINGS FROM THE PRESSURE MINIMUM INTEGRAL
Albrecht Eberle 27 Feb. 1978 71 p refs In GERMAN; ENGLISH summary
(MBB-UFE-1407-O) Avail: NTIS HC A04/MF A01

A finite volume method was derived from the variational principle of compressible potential flows. The change in the type of equations at transonic flow conditions with shocks is accounted for by the introduction of a special form of conservative artificial viscosity. Computed examples prove the reliability of the method. Author (ESA)

N79-24970# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Flugzeuge-Entwicklung.
THE COMPUTATION OF TRANSONIC FLOW IN WIND TUNNELS AT INLETS AND CASCADES USING THE FINITE ELEMENT METHOD
Albrecht Eberle 5 Apr. 1978 55 p refs In GERMAN; ENGLISH
(MBB-UFE-1421-O) Avail: NTIS HC A04/MF A01

A very flexible finite element/volume approach to the solution of classical potential transonic flow problems was developed to be used with computer methods for calculating theoretical flow past airfoil profiles. The solution assumes quasi two-dimensional flow. Since orthogonal meshgrids are not needed, the computer codes are extremely simple. As examples of applications the computation of transonic ducted flow in nozzles, wind tunnels, inlets, and plane cascades is shown. Author (ESA)

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N79-24971 British Library Lending Div., Boston Spa (England).
FORCASTING THE QUANTITATIVE CHARACTERISTICS OF AIRCRAFT ICING
K. G. Abramovich, G. V. Vasil'yeva, and V. M. Prokhorova 2 Jun. 1978 17 p refs Transl. into ENGLISH from Tr. Gidromet. Nauch.-Issled. Tsent. SSSR (Leningrad), v. 176, 1977 p 76-85 In ENGLISH and RUSSIAN
(BLL-Trans-1364-(9022.549)) Avail: British Library Lending Div., Boston Spa, Engl.

The quantitative characteristics of aircraft icing from data on the condition of the atmosphere in cloud layers, with the aid of statistical analysis by computer are presented. The differences between the computed and actual intensities are relatively small for moderate icing. For slight icing the computed values were enhanced while for severe icing they were depressed. The temperature and height of cloud base varied considerably within the limits of each class of intensity resulting in high mean values. M.M.M.

N79-24972*# Massachusetts Inst. of Tech., Cambridge. Flight Transportation Lab.
EFFECT OF FARE AND TRAVEL TIME ON THE DEMAND FOR DOMESTIC AIR TRANSPORTATION Final Report, Mar. 1978 - Mar. 1979
Steven E. Eriksen and Elliot W. Liu Apr. 1979 89 p refs (Contract NAS1-15268)
(NASA-CR-159072; FTL-R79-2) Avail: NTIS HC A05/MF A01 CSCL 01E

An econometric travel demand model was presented. The model was used for analyzing long haul domestic passenger markets in the United States. The results showed the sensitivities of demand to changes in fares and speed reflecting technology through more efficient aircraft designs. R.E.S.

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications.*

N79-24973*# Virginia Univ., Charlottesville. Research Labs. for the Engineering Sciences.
OPTIMIZATION OF MLS RECEIVERS FOR MULTIPATH ENVIRONMENTS Final Report
G. A. McAlpine and J. H. Highfill, III Jun. 1979 303 p refs (Grant NsG-1128)
(NASA-CR-158714; UVA/528062/EE79/107) Avail: NTIS HC A14/MF A01 CSCL 17G

The angle tracking problems in microwave landing system receivers along with a receiver design capable of optimal performance in the multipath environments found in air terminal areas were studied. Included were various theoretical and evaluative studies like: (1) signal model development; (2) derivation of optimal receiver structures; and (3) development and use of computer simulations for receiver algorithm evaluation. The development of an experimental receiver for flight testing is presented. An overview of the work and summary of principal results and conclusions are reported. M.M.M.

N79-24974# National Aviation Facilities Experimental Center, Atlantic City, N. J.
AN EVALUATION OF TURN ANTICIPATION TECHNIQUES AND OFFSET FLYING PROCEDURES USING A SINGLE-WAYPOINT RNAN SYSTEM Final Report, May - Nov. 1977
Bernard Goldberg, Donald Eldredge, and William Crimbring Jan. 1979 88 p refs
(FAA Proj. 044-326-350)
(AD-A066555; FAA-NA-78-41; FAA-RD-78-114) Avail: NTIS HC A05/MF A01 CSCL 17/7

The purpose is to document the results of a three-phased cockpit simulation which was conducted to evaluate turn application techniques applicable for use with a single-waypoint, general aviation type area navigation system. Techniques were evaluated for both centerline and offset tracking. Performance was measured for two variables: total system crosstrack error, and flight technical error. The major findings were: (1) all turn anticipation techniques tested could be used for centerline tracking; (2) no significant differences could be discovered between steady state and offset turn data; (3) a useable technique for turn anticipation during offset tracking is complex and contributes greatly to the pilot workload. J.A.M.

N79-24975# Communications Research Centre, Ottawa (Ontario).
RECEIVING ANTENNAS FOR THE NAVSTAR GLOBAL POSITIONING SYSTEM
R. Milne Oct. 1978 45 p refs
(AD-A067266; CRC-1319) Avail: NTIS HC A03/MF A01 CSCL 17/7

Two new types of shaped beam receiving antennas have been designed and developed at the Communications Research Centre for the NAVSTAR Global Positioning System. This report contains a description of the antennas, their principles of operation and their measured radiation patterns. Author (GRA)

N79-25994# Le Materiel Telephonique, Boulogne-Billancourt (France).
NEW GENERATIONS OF TACAN MATERIALS [NOUVELLES GENERATIONS DE MATERIELS TACAN]
J. C. Joguet *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 10 p In FRENCH (For primary document see N79-25977 16-99)
Avail: NTIS HC A16/MF A01

N79-26007# Le Materiel Telephonique, Boulogne-Billancourt (France).
DME TYPE DISTANCE MEASURING SYSTEMS: CURRENT STATUS AND FUTURE DEVELOPMENTS [LES SYSTEMES DE MESURE DE DISTANCE TYPE DME: ETAT ACTUEL ET DEVELOPPEMENTS FUTURS]
M. Schilliger *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 8 p refs In FRENCH (For primary document see N79-25977 16-99)
Avail: NTIS HC A16/MF A01

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

N79-24976* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SELF STABILIZING SONIC INLET Patent
Brent A. Miller, inventor (to NASA) Issued 15 May 1979 5 p Filed 29 Mar. 1978
(NASA-Case-LEW-11890-1; US-Patent-4,154,256; US-Patent-Appl-SN-891244; US-Patent-Class-137-15.1; US-Patent-Class-244-53B) Avail: US Patent and Trademark Office CSCL 01C

An inlet suitable for a turbine engine in a STOL, VTOL or CTOL aircraft is described. A circumferentially extended slot is provided in the inner surface of the air inlet at the windward side and downstream of the throat region. The slot communicates

with a circumferential plenum chamber formed in the front of the air inlet just behind the lip. Circumferentially extending rows of apertures are provided on the lip establishing two sets of apertures spaced circumferentially away from the slot in opposite directions. The slot removes the boundary layer from the critical portion of the diffuser to minimize or eliminate flow pressure loss or separations resulting from diffusion or tuning. The apertures are in a region of low static pressure on the lip of the inlet and serve as a source of suction to cause air flow into the slot.

Official Gazette of the U.S. Patent and Trademark Office

N79-24977 Stanford Univ., Calif.

A VARIATIONAL THEOREM FOR LAMINATED COMPOSITE PLATES OF NONLINEAR MATERIALS AND APPLICATIONS TO POSTBUCKLING Ph.D. Thesis

Robert Elon Anderson 1979 206 p

Avail: Univ. Microfilms Order No. 7912335

A prediction capability for the response under edge loading of anisotropic layered, flat plates composed of orthotropic laminae possessing nonlinear stress-strain characteristics was investigated. Confidence in the results presented for the prediction of laminated plate stress-strain response and the elasto-plastic postbuckling of one type of simply supported square laminated plate under axial compression loading is obtained by comparison of predictions based on current theory, analysis, and solution procedures with reliable experimental data and limiting case (isotropic and orthotropic) solution results. It was concluded that advanced composite laminates consisting of arbitrarily oriented orthotropic filamentary laminae are tractable by variational analysis and that such laminates, acting as uniaxially compressed postbuckled plates, are as fundamentally sensitive to material nonlinearity as their conventional metal counterparts. Dissert. Abstr.

N79-24978*# Douglas Aircraft Co., Inc., Long Beach, Calif.

CARGO LOGISTICS AIRLIFT SYSTEMS STUDY (CLASS). VOLUME 2: CASE STUDY APPROACH AND RESULTS

R. J. Burby and W. H. Kuhlman Oct. 1978 98 p Prepared in cooperation with Flying Tiger Line

(Contract NAS1-14948)

(NASA-CR-158913) Avail: NTIS HC A05/MF A01 CSCL 01C

Models of transportation mode decision making were developed. The user's view of the present and future air cargo systems is discussed. Issues summarized include: (1) organization of the distribution function; (2) mode choice decision making; (3) air freight system; and (4) the future of air freight. S.E.S.

N79-24979*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.

METHOD FOR OBSERVING THE FEATURES CHARACTERIZING THE SURFACE OF A LAND MASS Patent Application

Robert D. Reed, inventor (to NASA) Filed 30 May 1979 15 p

(NASA-Case-FRC-11013-1; US-Patent-Appl-SN-043912) Avail: NTIS HC A02/MF A01 CSCL 01C

A propeller driven, hydrazine powered aircraft remotely piloted through rarefied atmosphere of a selected planet, including the planet Earth, and employed as a communication platform for a telemetry system provided for relaying information relating to features characterizing the surface of the surface of the planet is described. NASA

N79-24980*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

A COOLING SYSTEM FOR AN AIRCRAFT HAVING A CRUISE RANGE FROM MACH 2 TO MACH 8 Patent Application

Pierce L. Lawing and Laverne L. Pagel, inventors (to NASA) (McDonnell Aircraft Co.) Filed 31 Jan. 1979 21 p

(NASA-Case-LAR-12406-1; US-Patent-Appl-SN-008210) Avail: NTIS HC A02/MF A01 CSCL 01C

The necessity of shielding an aircraft airframe constructed of material such as aluminum is eliminated by using a system which provides total cooling for an airframe designed to fly in the speed range of Mach 2 to Mach 8. Cooling is accomplished by passing a coolant through the aircraft airframe, the coolant acting as a carrier to remove heat from the airframe. The coolant is circulated through a heat pump and a heat exchanger which together extract essentially all of the added heat from the coolant. The heat is transferred to the aircraft fuel system via the heat exchanger and the heat pump. The heat extracted from the coolant is utilized to power the heat pump. The heat pump is associated with a power turbine mechanism which is also driven by the extracted heat. The power turbines are utilized to drive various aircraft subsystems, the compressor of the heat pump, and provide engine cooling. This system is accomplished with a small increase in aircraft weight and a total result of a small increase in performance. NASA

N79-24981# Douglas Aircraft Co., Inc., Long Beach, Calif.

FEASIBILITY AND COST EFFECTIVENESS OF AIRBORNE TIRE PRESSURE INDICATING SYSTEMS Final Report, Sep. 1977 - Sep. 1978

R. Suiter Oct. 1979 122 p refs

(Contract DOT-FA77WA-4070)

(AD-A065513; FAA-RD-78-134-1) Avail: NTIS HC A06/MF A01 CSCL 01/3

The wheel mounted pressure readout gauges and devices and cockpit tire pressure warning indicators for air carrier transports having 6,10, and 18 wheels are studied. Typical wheel mounted readout devices and eleven conceptual cockpit indicating systems are discussed. Information on accuracy, temperature compensation requirements, weight, installation cost, system cost, and system maintenance cost is provided. A study of tire failures is made for 1973-1976 identifying rate of tire failures and aircraft damage costs resulting from tire failures. Sixty-five percent of airframe damage cost is related to underinflation - induced or related tire failures which may be avoided by a property designed tire pressure indicating system. Average airframe damage cost per departure for each study aircraft, based on actual airline data, is presented with comments on delay and cancellation costs. Aircraft damage costs and tire maintenance costs may be avoided are compared to tire pressure indicating system life cycle costs to shot that tire pressure systems are basically feasible, but marginally cost effective aircraft testing of promising systems is recommended. M.M.M.

N79-24982# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.

PROCEEDINGS OF AFFDL FLYING QUALITIES SYMPOSIUM Interim Report, Aug. 1973 - Sep. 1978

G. Thomas Black, David J. Moorhouse, and Robert J. Woodcock Dec. 1978 639 p refs Symp. held at Dayton, Ohio, 12-15 Sep. 1978

(AD-A066493; AFFDL-TR-78-171) Avail: NTIS HC A99/MF A01 CSCL 01/2

The symposium was sponsored by the Air Force Flight Dynamics Laboratory as part of an effort to revise MIL-F-8785B, 'Military Specification, Flying Qualities of Piloted Airplanes'. Flying Qualities specialists were brought together from industry government agencies, and university. Topics for discussion were (1) experience and problems with MIL-F-8785B, (2) revisions to MIL-F-8785B currently proposed by AFFDL/FGC, (3) a new format for the flying qualities requirements, and (4) future requirements in general. Full-length and informal papers were solicited to address any of the preceding topics. In addition, working sessions were organized to discuss the current revisions and future requirements from the viewpoints of different technical disciplines. This report contains the papers and summaries of the working sessions, as submitted by the authors. GRA

N79-24983# Boeing Vertol Co., Philadelphia, Pa.

HELICOPTER TRANSMISSION VIBRATION AND NOISE REDUCTION PROGRAM. VOLUME 3: EVALUATION OF FIBER FP METAL-MATRIX HOUSING SPECIMENS Final Report, Mar. - Oct. 1978

Joseph W. Lenski, Jr. Jan. 1979 100 p refs

(Contract DAAJ02-74-C-0040; DA Proj. 1G2-62207-AH-89)

(AD-A066794; D210-11442-1-Vol-3;

USARTL-TR-78-2C-Vol-3) Avail: NTIS HC A05/MF A01 CSCL 01/3

The objective of the work performed under this contract was to demonstrate selective reinforcement of a cast magnesium housing by the use of high-modulus FP fibers via casting technology. A series of housing element specimens were designed,

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fabricated, and tested to evaluate the application of state-of-the-art technology to the fabrication of a full-scale, fiber-reinforced metallic transmission housing. Several typical housing section specimens were fabricated and tested to determine material properties. These properties were compared with predicted values to develop the technology and analytical capability for the application of selective reinforcement of a full-scale helicopter transmission housing, with the final objective of reducing system deflections, noise, and vibration. Author (GRA)

N79-24984# General Dynamics/Fort Worth, Tex.
COMPOSITE FORWARD FUSELAGE SYSTEMS INTEGRATION, VOLUME 2 Final Report, Apr. 1977 - May 1978
B. J. Wallace, B. J. C. Burrows, R. T. Zeitler, A. J. Ledwig, and K. G. Wiles Sep. 1978 149 p refs
(Contract F33615-76-C-5439)
(AD-A066560; AFFDL-TR-78-110-Vol-2) Avail: NTIS HC A07/MF A01 CSCL 01/3

The Composite Forward Fuselage Systems Integration program has performed the development necessary to guide the integration of avionic and electrical systems into composite aircraft structure. This volume of the report presents one phase of the program; it presents that phase in which the induced effects of lightning are identified and modeled. GRA

N79-24985# Sikorsky Aircraft, Stratford, Conn.
AEROELASTICALLY CONFORMABLE ROTOR MISSION ANALYSIS Final Report
Robert H. Blackwell and Sebastian J. Cassarino Mar. 1979 76 p refs
(Contract DAAJ02-77-C-0041; DA Proj. 1L2-62209-AH-76)
(AD-A067338; SER-510017; USARTL-TR-79-5) Avail: NTIS HC A05/MF A01 CSCL 01/3

An analytic study was conducted to assess the suitability of a conformable rotor for satisfying the requirements of a typical Army mission. A conformable rotor blade is a blade designed to produce changes in blade twist, with azimuth and flight condition, which improve performance and reduce rotor loads. This study quantified the performance advantages and rotor system load reductions possible with a conformable rotor by designing blades suited for the UH-60A mission and comparing calculated rotor behavior with that of the UH-60A rotor. Relative to the UH-60A design, the conformable blade employs a four-to-one reduction in torsional stiffness over the outer half of the blade a reduction in built-in twist from -16 to -12 degrees, an increase from 20 to 30 degrees in tip sweep and reflex tab deflection inboard of the 80-percent radial position. This design produces elastic response which increase twist in hover and reduces advancing blade twist in forward flight. GRA

N79-24986# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Flugzeuge-Entwicklung.
POLAR LIFT AND DRAG DETERMINATION DURING FLIGHT TESTS [ERMITTLUNG VON AUFTRIERS UND WIDERSTANDSPOLAREN IM FLUGVERSUCH]
A. Knaus 1 Mar. 1978 70 p In GERMAN Presented at DGLR-Colloq. Flugversuchserfahren im Milit. Bereich, Manching, West Ger., 20-21 Apr. 1978
(MBB-UFE-1410-O) Avail: NTIS HC A04/MF A01

The various measurements and equipment necessary to determine the aerodynamic performance of an aircraft (stationary, normal flight, maneuvering) are discussed. Techniques developed for the Tornado test flight program are presented. Measurements, corresponding measurement parameters, and theoretical considerations are given. For this aircraft, lift and drag characteristics were determined over a complete range of attack angles with an accuracy of between 4 percent and 5 percent. Fully automated data handling techniques permit the results to be analyzed in minimum time. Author (ESA)

N79-24987# General Accounting Office, Washington, D. C. Procurement and Systems Acquisition Div.
IS THE AV-8B ADVANCED HARRIER AIRCRAFT READY FOR FULL-SCALE DEVELOPMENT
30 Jan. 1979 29 p
(PB-290826/7; PSAD-79-22) Avail: NTIS HC A03/MF A01 CSCL 01C

The AV-8B Advanced Harrier aircraft reach the decision milestone for going into fullscale development. GAO was advised by Department of Defense officials that the President and the Secretary of Defense decided not to request any funds for the AV-8B program and that the Under Secretary of Defense for Research and Engineering also refused to permit the Navy to obligate $108 million of the $123 million in full-scale development funds that was appropriated. Unless this action is reversed by the Congress,the AV-8B program will effectively be terminated. GRA

N79-25005# Kongsberg Vapenfabrikk A/S (Norway). Defense Products Div.
MSI-80S: AN INTEGRATED SMALL-CRAFT FIRE CONTROL SYSTEM
F. A. Ostern *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 15 p (For primary document see N79-25977 16-99)
Avail: NTIS HC A16/MF A01

N79-25006# Naval Weapons Center, China Lake, Calif.
JOINT TACTICAL INFORMATION DISTRIBUTION SYSTEM (JTIDS): WEAPON GUIDANCE AND WEAPON DELIVERY APPLICATIONS OF JTIDS
Claude E. Owen *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 8 p (For primary document see N79-25977 16-99)
Avail: NTIS HC A16/MF A01

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N79-24988*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
A SYSTEM FOR PROVIDING AN INTEGRATED DISPLAY OF INSTANTANEOUS INFORMATION RELATIVE TO AIRCRAFT ATTITUDE, HEADING, ALTITUDE, AND HORIZONTAL SITUATION Patent Application
Robert James, inventor (to NASA) (James and Assoc., Lancaster, Calif.) Filed 30 May 1979 45 p
(Contract NAS4-2199)
(NASA-Case-FRC-11005-1; US-Patent-Appl-SN-043942) Avail: NTIS HC A03/MF A01 CSCL 01D

A display device is described which provides an aircraft pilot with combined inflight attitude, heading, altitude, and horizontal situation information. This invention combines a commonly used and commercially available flight director-type devices for a display in combination with a miniature aircraft supported for angular displacement from a vertical orientation to indicate heading error, or heading offset. An extended course deviation indicator bar is also provided which projects into juxtaposition with the miniature aircraft for providing a true picture of the aircraft's horizontal situation relative to a selected VOR, ILS, or MLS course. NASA

N79-24989# Lockheed-California Co., Burbank. Advanced Avionics Dept.
ANALYSIS OF THE IMPACT OF A 270 VDC POWER SOURCE ON THE AVIONIC POWER SUPPLIES IN THE S-3A AIRCRAFT Final Report, Nov. 1977 - Nov. 1978
27 Nov. 1978 232 p refs
(Contract N62269-78-C-0007)
(AD-A066526; LR-28780; NADC-79012-60) Avail: NTIS HC A11/MF A01 CSCL 09/5

The objective of this analysis was to determine the total platform impact on an S-3A avionic suite outfitted with 270 V DC switched mode regulators in lieu of standard 115/200 V, 400 Hz transformer coupled series regulators and to quantify the resulting impact in terms of changes to aircraft weight, mission performance, fuel usage, reliability, and LCC. Author (GRA)

N79-24990# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
A REVIEW OF THE 3M DATA BASE FOR FAULT-TOLERANT SYSTEM INCENTIVES Final Report, Jul. 1977 - Dec. 1978
Albert L. Hopkins, Jr. Jan. 1979 37 p refs
(Contract N00014-76-C-0502)
(AD-A066697; R-1244) Avail: NTIS HC A03/MF A01 CSCL 17/2

This report covers the second phase of the subject contract, whose first phase was the study of a hierarchical form of a fault-tolerance data communication network. The second phase task involved an examination of the Navy's '3-M' (maintenance material management) data base to see if any evidence was readily available or easily extractable to affirm or refute the hypotheses underlying fault-tolerant system design. A large volume of aggregate data was examined for three aircraft types, the E-2C, the P-3C, and the S-3A. Several broad conclusions were reached with respect to the fault-tolerant system design hypotheses. Some observations and interferences are presented to conclude this report. Author (GRA)

N79-24991# Honeywell, Inc., Minneapolis, Minn. Systems and Research Center.
COLOR DISPLAY DESIGN GUIDE Final Report, 15 Apr. 1977 - 31 Dec. 1978
Marjorie J. Krebs, James D. Wolf, and John H. Sandvig Oct. 1978 224 p refs
(Contract N00014-77-C-0349)
(AD-A066630; HONEYWELL-78SRC79; ONR-CR-213-136-2F) Avail: NTIS HC A10/MF A01 CSCL 01/3

The objective was to develop a design guide for the use of color in advanced avionics displays. Study results are presented in two parts. Part I presents principles for use of color, plus supporting data where such data exist. Principles of Part I are general and can be applied in virtually any application involving color coding of display information. Part II represents the application of these principles to real-world cockpit displays. Recommended color codes are developed for application to electronic displays in fighter/attack aircraft. Examples of representative display formats incorporating the recommended coding are provided. Author (GRA)

N79-24992# Vought Corp., Dallas, Tex.
AAES/TA-7C CONTROL AND DISPLAY INTERFACE Final Report, May - Oct. 1978
J. R. Perkins, D. E. Lautner, and A. J. Marek Oct. 1978 62 p refs
(Contract N62269-78-C-0126)
(AD-A067219; Rept-2-54-00/8R-3512; NADC-77326-60) Avail: NTIS CSCL 09/3

This program was conducted for establishing requirements and developing specific design data for a hot bench mockup (simulator). The simulator system being developed is based on the AAES Prototype Design evolved by the Vought corporation under contract N62269-75-C-0391. The simulator system will ulitimately be used by NADC to provide a laboratory verification of the operation and performance of the AAES in an aircraft weapon system environment. The evolved simulator design is formulated around the TA-7C aircraft electrical and avionic systems and the general physical/installation constraints of the TA-7C forward and mid fuselage sections. The designs developed under this contract were limited to electrical-avionic system definition and design primarily in the control and display areas. Simulator structural, system installation and wire harness designs are planned for development under a follow-up contract. The designs developed under this contract include the full application of the AADS technologies to the TA-7C electrical and avionic subsystems and systems. The AAES technologies include HVDC (High Voltage DC) Power Generation, SOSTEL (Solid State Electrical Logic) Power Distribution and Management, and AMUX (Avionic Multiplexing). Author (GRA)

N79-24993# Advisory Group for Aerospace Research and Development, Paris (France).
PROCESSING OF AIRBORNE RECONNAISSANCE DATA FOR IN-FLIGHT DISPLAY AND NEAR REAL-TIME TRANSMISSION
G. vanKeuk (Forschungsinst. fuer Funk und Math.) Mar. 1979 67 p refs
(AGARD-AR-135; ISBN-92-835-1310-X) Avail: NTIS HC A04/MF A01

Communication on aircraft beyond the horizon is discussed. The fundamental relationships between several parameters and interactions and between human factors and technology to assist operational and technical users were examined. S.E.S.

N79-25979# Naval Air Systems Command, Washington, D. C.
AVIONICS TECHNOLOGY FOR TACTICAL DATA HANDLING
E. B. Beggs *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 8 p (For primary document see N79-25977 16-99)
Avail: NTIS HC A16/MF A01

N79-25991# Naval Air Development Center, Warminster, Pa.
THE APPLICATION OF STRUCTURED DESIGN AND DISTRIBUTED TECHNIQUES TO AVIONICS INFORMATION PROCESSING ARCHITECTURES
Louis A. Naglak and William M. Norr *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 17 p refs (For primary document see N79-25977 16-99)
Avail: NTIS HC A16/MF A01

N79-25999# Singer Co., Wayne, N. J.
PARNAS PARTITIONING
Austin J. Maher *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 11 p refs (For primary document see N79-25977 16-99)
Avail: NTIS HC A16/MF A01

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N79-24994*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PREMIXED PREVAPORIZED COMBUSTOR TECHNOLOGY FORUM
1979 262 p refs Conf. held at Cleveland, Ohio, 9-10 Jan. 1979
(NASA-CP-2078; E-9933) Avail: NTIS HC A12/MF A01 CSCL 21E

The Forum was held to present the results of recent and current work intended to provide basic information required for demonstration of lean, premixed prevaporized combustors for aircraft gas turbine engine application. Papers are presented which deal with the following major topics: (1) engine interfaces; (2) fuel-air preparation; (3) autoignition; (4) lean combustion; and (5) concept design studies. For individual titles, see N79-24995 through N79-25014.

N79-24995*# Pratt and Whitney Aircraft Group, East Hartford, Conn.
TURBULENCE CHARACTERISTICS OF COMPRESSOR DISCHARGE FLOWS
Howard P. Grant *In* NASA. Lewis Res. Center Premixed Prevaporized Combustor Technol. Forum 1979 p 5-31 (For primary document see N79-24994 16-07)
Avail: NTIS HC A12/MF A01 CSCL 21E

Turbulence measurements were conducted in a large gas turbine engine (JT9D) at the entrance to the diffuser duct, joining the compressor discharge to the combustor inlet. Hot film probe and hot wire probe measurements were obtained at temperatures from 450K (350F) (idle) to 608K (635F) (rich approach). At I.D. (25 percent span) and mid-span locations, the turbulence intensity increased slightly from 6 + or - percent at idle condition to 7 or - 1 percent at rich approach. At O.D. (75 percent span) the turbulent intensity increased more rapidly, from 7.5 + or

- 0.5 percent at idle to 15 + or - 0.5 percent at rich approach. The spectra showed turbulent energy distributed uniformly over a 0.1 to 5 KHz bandwidth (down 3db) at all operating conditions, corresponding to random turbulence with velocity wave lengths of 2 cm to 1 meter travelling at the mean velocity of 100 m/sec. Tests results are given in tables and graphs. A.R.H.

N79-24996*# General Electric Co., Cincinnati, Ohio.
TURBULENCE MEASUREMENTS IN THE COMPRESSOR EXIT FLOW OF A GENERAL ELECTRIC CF6-50 ENGINE
Jack R. Taylor *In* NASA. Lewis Res. Center Premixed Prevaporized Combustor Technol. Forum 1979 p 33-45 (For primary document see N79-24994 16-07)
Avail: NTIS HC A12/MF A01 CSCL 21E

Ruggedized cooled film probes were used to measure CF6-50 compressor exit turbulence properties at three different engine idle condition test points. The turbulence probe was coupled to a constant temperature anemometer and signal conditioning system. An on-line readout system connected to the anemometer was used to check the data as it was acquired. At engine idle conditions, the turbulence intensity ranged from 4.8 percent to 5.6 percent and the length scale ranged from 5.64 cm to 6.95 cm. The length scale values are somewhat larger than the passage height at the measurement plane (5.54 cm), which indicates that the shape of the turbulent eddies are elongated in the axial direction. The microscale values range from about 0.73 cm to about 0.98 cm. Power spectral density distributions show that a large proportion of the turbulent energy at the measurement plane is concentrated at frequencies below one kilohertz. A.R.H.

N79-24997*# Solar Turbines International, San Diego, Calif.
FUEL SPRAY DATA WITH LDV
David A. Rohy and John G. Meier *In* NASA. Lewis Res. Center Premixed Prevaporized Combustor Technol. Forum 1979 p 47-55 (For primary document see N79-24994 16-07)
Avail: NTIS HC A12/MF A01 CSCL 21E

Droplet size and two component velocities in the severe environment of an operating gas turbine combustor system can be measured simultaneously using the solar laser morphokinetomer (SLM) which incorporates the following capabilities: (1) measurement of a true two-dimensional velocity vector with a range of + or - (0.01-200 m/sec); (2) measurement of particle size (range 5 to 300 micron m) simultaneously with the measurement of velocity; (3) specification of probe volume position coordinates with a high degree of accuracy (+ or - 0.5 mm); (4) immediate on-line data checks; and (5) rapid computer storage of acquired data. The optical system of the SLM incorporates an ultrasonic beam splitter to allow the measurement of a two-dimensional velocity vector simultaneously with particle size. A microprocessor with a limited storage capability permits immediate analysis of test data in the test cell. A.R.H.

N79-24998*# United Technologies Research Center, East Hartford, Conn.
MODELING OF PREMIXING-PREVAPORIZING FUEL-AIR MIXING PASSAGES
O. L. Anderson, J. B. McVey, D. E. Edwards, and L. M. Chiappetta *In* NASA. Lewis Res. Center Premixed Prevaporized Combustor Technol. Forum 1979 p 57-65 (For primary document see N79-24994 16-07)
Avail: NTIS HC A12/MF A01 CSCL 21E

The development of a computer program for the analytical prediction of the distribution of liquid and vapor fuel in the premixing-prevaporizing passage by the direct injection method is described. The technical approach adopted for this program is to separate the problem into three parts each with its own computer code. These three parts are: calculation of the two-dimensional or axisymmetric air flow; calculation of the three-dimensional fuel droplet evaporation; and calculation of the fuel vapor diffusion. This method of approach is justified because premixing passages operate at lean equivalence ratios. Hence, a weak interaction assumption can be made wherein the airflow can affect the fuel droplet behavior but the fuel droplet behavior does not affect the airflow. A.R.H.

N79-24999*# Michigan Univ., Ann Arbor.
EFFECT OF FUEL SPRAYS ON EMISSIONS
J. A. Nicholls *In* NASA. Lewis Res. Center Premixed Prevaporized Combustor Technol. Forum 1979 p 67-84 refs (For primary document see N79-24994 16-07)
(Grant NsG-3148)
Avail: NTIS HC A12/MF A01 CSCL 21E

A research gas turbine combustor was operated under realistic conditions such that the influence of individual variables (in particular, fuel spray characteristics) on emissions could be determined. The special combustor allows independent control over drop size, fuel-air ratio, air inlet temperature, pressure, reference velocity, and residence time. Also, it lends itself to theoretical modeling and turbulent intensity measurements through use of laser velocimetry. Emission results for a range of operations are presented. A number of graphs show which show the variations of emissions levels with one variable at a time are included. In every case, the fuel is jet A, the pressure is atmospheric, and combustion is limited to a primary zone.A.R.H.

N79-25000*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE OF A MULTIPLE VENTURI FUEL-AIR PREPARATION SYSTEM
Robert R. Tacina *In its* Premixed Prevaporized Combustor Technol. Forum 1979 p 85-93 refs (For primary document see N79-24994 16-07)
Avail: NTIS HC A12/MF A01 CSCL 21E

Spatial fuel-air distributions, degree of vaporization, and pressure drop were measured 16.5 cm downstream of the fuel injection plane of a multiple Venturi tube fuel injector. Tests were performed in a 12 cm tubular duct. Test conditions were: a pressure of 0.3 MPa, inlet air temperature from 400 to 800K, air velocities of 10 and 20 m/s, and fuel-air ratios of 0.010 and 0.020. The fuel was Diesel #2. Spatial fuel-air distributions were within + or - 20 percent of the mean at inlet air temperatures above 450K. At an inlet air temperature of 400K, the fuel-air distribution was measured when a 50 percent blockage plate was placed 9.2 cm upstream of the fuel injection plane to distort the inlet air velocity fuel injection plane to distort the inlet air velocity profile. Vaporization of the fuel was 50 percent complete at an inlet air temperature of 400K and the percentage increased linearly with temperature to complete vaporization at 600K. The pressure drop was 3 percent at the design point which was three times greater than the designed value and the single tube experiment value. No autoignition or flashback was observed at the conditions tested. A.R.H.

N79-25001*# United Technologies Research Center, East Hartford, Conn.
AUTOIGNITION OF FUELS
Louis J. Spadaccini *In* NASA. Lewis Res. Center Premixed Prevaporized Combustor Technol. Forum 1979 p 95-107 ref (For primary document see N79-24994 16-07)
Avail: NTIS HC A12/MF A01 CSCL 21E

An autoignition test section and a premixing fuel injector developed to determine the autoignition characteristics of a variety of aircraft fuels are described. Parametric tests to map the ignition delay characteristics of Jet-A fuel were conducted at pressures of 10, 15, 20, 25, and 30 atm, inlet air temperatures up to 900K and fuel-air equivalence ratios of 0.3, 0.5, 0.7, and 1.0. Residence times in the range of 1 to 50 msec were obtained by interchanging spool pieces to create six different mixer/vaporizer lengths (6, 23, 53, 84, 99, and 130 cm) and by testing at two different airflow rates (0.5 and 1.0 kg/sec). The resulting free-stream velocities were in the range 20 to 100 m/sec. As expected, the results indicate that the ignition delay times decrease with increasing air temperature and pressure. Also, the data show that, for lean mixtures, ignition delay times decrease with increasing equivalence ratios. A.R.H.

N79-25002*# General Applied Science Labs., Inc., Westbury, N. Y.
EMISSIONS MEASUREMENTS FOR A LEAN PREMIXED PROPANE/AIR SYSTEM AT PRESSURES UP TO 30 ATMOSPHERES
Gerald Roffe *In* NASA Lewis Res. Center Premixed Prevaporized Combustor Technol. Forum 1979 p 109-125 Forum 1979 p 109-125 (For primary document see N79-24994 16-07)
Avail: NTIS HC A12/MF A01 CSCL 21E

A series of experiments was conducted in which the emissions of a lean premixed system of propane and air were measured at pressures of 5, 10, 20 and 30 atm in a flametube apparatus. Measurements were made for inlet temperatures between 600K and 1000K and combustor residence times from 1.0 to 3.0 msec. A schematic of the test rig is presented along with graphs showing emissions measurements for nitric oxide, carbon monoxide, and UHC as functions of bustor residence time for various equivalence ratios, entrance temperatures and pressures; typical behavior of emissions as a function of equivalence ratio for a fixed residence time. Correlations of nitric oxide emission index with adiabatic flame temperature for a fixed residence time of 2 msec and pressures from 5 to 30 atm; and adiabatic flame temperature corresponding to CO breakpoint conditions for 2 msec residence time as a function of inlet temperature.
A.R.H.

N79-25003*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF DEGREE OF FUEL VAPORIZATION ON EMISSIONS FOR A PREMIXED-PREVAPORIZED COMBUSTOR SYSTEM
Larry P. Cooper *In its* Premixed Prevaporized Combustor Technol. Forum 1979 p 127-130 (For primary document see N79-24994 16-07)
Avail: NTIS HC A12/MF A01 CSCL 21E

The impact of the degree of fuel vaporization upon emission from a flametube combustor was studied using an inlet air pressure of 3 x 10 to the 5th power pascals, inlet air temperatures of 600K and 700K, a reference velocity of 35 meters per second and equivalence ratios of .6 and .72 using Jet A fuel. Incoming air was preheated to temperatures from 600K to 700K by a nonvitiating preheater. Jet A fuel was injected into this airstream through two different fuel injectors manifolded together and mounted in series upstream of a watercooled preforated plate flameholder. The fuel-air mixture burned in a watercooled combustor section. Samples of the fuel-air mixture upstream of the flameholder were obtained for analysis to determine the local degree of fuel vaporization and the fuel-air ratio. Samples of the combustion products were analyzed to determine gaseous emissions. The effects of vaporization on carbon monoxide and nitric on carbon monoxide and nitric oxide emissions are presented.
A.R.H.

N79-25004*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF FUEL/AIR NONUNIFORMITY ON NITRIC OXIDE EMISSIONS
Valerie J. Lyons *In its* Premixed Prevaporized Combustor Technol. Forum 1979 p 131-134 (For primary document see N79-24994 16-07)
Avail: NTIS HC A12/MF A01 CSCL 21E

A flame tube combustor holding jet A fuel was used in experiments performed at a pressure of .3 Mpa and a reference velocity of 25 meters/second for three inlet air temperatures of 600, 700, and 800 K. The gas sample measurements were taken at locations 18 cm and 48 cm downstream of the perforated plate flameholder. Nonuniform fuel/air profiles were produced using a fuel injector by separately fueling the inner five fuel tubes and the outer ring of twelve fuel tubes. Six fuel/air profiles were produced for nominal overall equivalence ratios of .5 and .6. An example of three of three of these profiles and their resultant nitric oxide NOx emissions are presented. The uniform fuel/air profile cases produced uniform and relatively low profile levels. When the profiles were either center-peaked or edge-peaked, the overall mass-weighted nitric oxide levels increased.
A.R.H.

N79-25005*# General Applied Science Labs., Inc., Westbury, N. Y.
EFFECTS OF FLAMEHOLDER GEOMETRY ON EMISSIONS AND PERFORMANCE OF LEAN PREMIXED COMBUSTORS
K. S. Venkataramani *In* NASA. Lewis Res. Center Premixed Prevaporized Combustor Technol. Forum 1979 p 135-155 (For primary document see N79-24994 16-07)
Avail: NTIS HC A12/MF A01 CSCL 21E

Emission levels and performance of twelve flameholder designs were investigated in a lean, premixed propane-air system at inlet conditions of 800K and 10 atm. The flameholder tested represents six design concepts with two values of blockage for each concept. The design concept consists of the following geometries: perforated plate, wire grid, single cone, multiple cone, vee gutter and swirl cone. Measurements were made at reference velocities of 35 m/s, 25 m/s and 20 m/s at combustor stations 10 cm and 30 cm downstream of the flameholder. G.Y.

N79-25006*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECTS OF FLAMEHOLDER BLOCKAGE ON EMISSIONS AND PERFORMANCE OF LEAN PREMIXED-PREVAPORIZED COMBUSTORS
Robert A. Duer *In its* Premixed Prevaporized Combustor Technol. Forum 1979 p 157-162(For primary document see N79-24994 16-07)
Avail: NTIS HC A12/MF A01 CSCL 21E

The results from a parametric study are presented. Tests were on conducted at inlet air pressure of 300,000 and 500,000 pascals, inlet air temperatures of 600K, 700K and 800K, reference velocites from 20 to 35 meters per second, and equivalent ratios from the lean stability limit to 0.7 using Jet A fuel. The tests were conducted in a closed duct test facility. Results from the test support the theory that flameholder blockage is one of the major determinants of the size and shape of the recirculation zone. The test data show that higher blockage with its larger recirculation zone provides more residence time which leads to more NOx formation.
G.Y.

N79-25007*# United Technologies Research Center, East Hartford, Conn.
LEAN STABILITY AUGMENTATION STUDY
John B. McVey and Jan B. Kennedy *In* NASA. Lewis Res. Center Premixed Prevaporized Combustor Technol. Forum 1979 p 163-177 (For primary document see N79-24994 16-07)
Avail: NTIS HC A12/MF A01 CSCL 21E

An analytical and experimental program was conducted to investigate techniques and develop technology for improving the lean combustion limits of premixing, prevaporizing combustors applicable to gas turbine engine main burners. Three concepts for improving lean stability limits were selected for experimental evaluation among twelve approaches considered. Concepts were selected on the basis of the potential for improving stability limits and achieving emission goals, the technological risks associated with development of practical burners employing the concepts, and the penalties to airline direct operating costs resulting from decreased combustor performance, increased engine cost, increased maintenance cost and increased engine weight associated with implementation of the concepts. Tests of flameholders embodying the selected concepts were conducted.
G.Y.

N79-25008*# Massachusetts Inst. of Tech., Cambridge.
MODELLING TURBULENT FLAME IGNITION AND BLOW-OUT
Krishnan Radhakrishnan and John B. Heywood *In* NASA. Lewis Res. Center Premixed Prevaporized Combustor Technol. Forum 1979 p 179-186 refs (For primary document see N79-24994 16-07)
(Grant NGR-22-009-378)
Avail: NTIS HC A12/MF A01 CSCL 21E

A statistical mixing model incorporating an overall rate equation to descripe the fuel oxidation process was developed for studies of ignition and blowout in a combustor primary zone. This zone is treated as a partially stirred reactor whose composition is described by a statistical ensemble of equal mass fluid elements. This ensemble experiences mixing interactions, which represent the turbulent mixing process, at time intervals governed by an empirically determined mixing frequency. Each mixing interaction is computed by ramdomly selecting two different elements which are then allowed to mix completely so that they reach a mean composition depending on their thermodynamic states prior to mixing. The two elements then separate, and the chemical kinetics proceed depending on their new composition and temperature.
G.Y.

N79-25009*# California Univ., Berkeley.
STABILIZATION OF PREMIXED COMBUSTORS
R. F. Sawyer, J. W. Daily, and A. K. Oppenheim *In* NASA. Lewis Res. Center Premixed Prevaporized Combustor Technol. Forum 1979 p 187-202 (For primary document see N79-24994 16-07)
Avail: NTIS HC A12/MF A01 CSCL 21E

In order to attain a sufficiently good insight into the fluid mechanical processes taking place in combustors operating on premixed, prevaporized, and preheated gases, an experimental facility was developed where the flow field is tractable both experimentally and analytically. The configuration adopted for the initial stage of the study is based on the use of a step to stabilized the combustion zone. The primary purpose of the experimental apparatus is to provide a facility for studying the effects of the elementary fluid mechanical processes on the stability of a model combustion system in order to further the understanding of the intrinsic mechanism of nonsteady phenomena, rather than to provide criteria for unstable operation of combustors, as expressed by overall performance parameters, such as the blowout and flashback limits. G.Y.

N79-25010*# Cornell Univ., Ithaca, N. Y.
EFFECT OF SWIRL ON PREMIXED COMBUSTION
F. C. Gouldin and S. Leibovich *In* NASA. Lewis Res. Center Premixed Prevaporized Combustor Technol. Forum 1979 p 203-213 (For primary document see N79-24994 16-07)
Avail: NTIS HC A12/MF A01 CSCL 21E

Combustion in a premixed swirl combustor composed of confined concentric jets (5 cm and 10 cm diameter) were studied. The inner flow is fuel and air; the outer flow is air. Both flows may contain swirl either in the same or opposite directions. The combustor operates at one atmosphere without preheat; methane and propane were used as fuels. Related analyses and experiments were also performed for water flows and isotherm air flows. In these studies, a number of important concepts regarding premixing/prevaporized, swirl stabilized combustion were developed. Some of the more significant are discussed. G.Y.

N79-25011*# General Electric Co., Cincinnati, Ohio.
ADVANCED LOW EMISSIONS CATALYTIC COMBUSTOR PROGRAM AT GENERAL ELECTRIC
W. J. Dodds *In* NASA. Lewis Res. Center Premixed Prevaporized Combustor Technol. Forum 1979 p 215-227 refs (For primary document see N79-24994 16-07)
Avail: NTIS HC A12/MF A01 CSCL 21E

The Advanced Low Emissions Catalytic Combustors Program (ALECC) is being undertaken to evaluate the feasibility of employing catalytic combustion technology in aircraft gas turbine engines as a means to control emission of oxides of nitrogen during subsonic stratospheric cruise operation. The ALECC Program is being conducted in three phases. The first phase, which was completed in November, 1978, consisted of a design study to identify catalytic combustor designs having the greatest potential to meet the emissions and performance goals specified. The primary emissions goal of this program was to obtain cruise NO emissions of less than 1g/kg (compared with levels of 15 to 20 g/x obtained with current designs)/ However, good overall performance and feasibility for engine development were heavily weighted in the evaluation of combustor designs. G.Y.

N79-25012*# Pratt and Whitney Aircraft Group, East Hartford, Conn.
ADVANCED LOW EMISSIONS CATALYTIC COMBUSTOR PROGRAM AT PRATT AND WHITNEY
G. J. Sturgess *In* NASA. Lewis Res. Center Premixed Prevaporized Combustor Technol. Forum 1979 p 229-245 (For primary document see N79-24994 16-07)
Avail: NTIS HC A12/MF A01 CSCL 21E

The feasibility of employing catalytic combustion technology to control the emissions of oxides of nitrogen for subsonic, stratospheric cruise aircraft operations is the objective of this NASA contract. The existing Enivornmental Protection Agency standards for the landing and takeoff cycle were also required to be satisfied. Work for the first phase of a proposed three phase effort is reported and is concerned with analytical design studies. G.Y.

N79-25013*# Pratt and Whitney Aircraft Group, East Hartford, Conn.
LEAN, PREMIXED, PREVAPORIZED COMBUSTOR CONCEPTUAL DESIGN STUDY
Anthony J. Fiorentino *In* NASA. Lewis Res. Center Premixed Prevaporized Combustor Technol. Forum 1979 p 247-254 (For primary document see N79-24994 16-07)
Avail: NTIS HC A12/MF A01 CSCL 21E

The seven month study program has the objective to identify and evaluate promising lean, premixed, prevaporized combustor concepts utilizing variable geometry and/or other flow control techniques. The general approach taken to accomplish this objective is outlined and consists of combustor design, design analysis and design ranking. The schedule being taken to achieve this program is shown. Although the ultimate goal of this program is the significant reduction of cruise oxides of nitrogen, both the EPA emission standards and combustor performance levels outlined are retained as goals as well. G.Y.

N79-25014*# General Electric Co., Cincinnati, Ohio.
LEAN, PREMIXED, PREVAPORIZED COMBUSTOR CONCEPTUAL DESIGN STUDY
E. E. Ekstedt *In* NASA. Lewis Res. Center Premixed Prevaporized Combustor Technol. Forum 1979 p 255-263 (For primary document see N79-24994 16-07)
Avail: NTIS HC A12/MF A01 CSCL 21E

Phase 1 of the Lean Premixed-Prevaporized Comubstor Design Study is a nine month analytical study effort with no experimental or testing activities included. The program has the objective to design and analyze advanced combustor concepts with features for fuel premixing and prevaporization upstream of the combustion zone for use in future subsonic aircrafts with features for fuel premixing and prevaporization upstream of the combustion zone for use in future subsonic aircraft engines. All of the designs also embody some form of variable geometry for combustor flow modulation. The primary criterion for these designs is low oxides of nitrogen emissions at stratospheric cruise conditions. Four combustor concepts are being designed for the NASA/GE Energy Efficient Engine (EEE) envelope and cycle. Current status of the program is that the four concepts sized for the EEE were designed and are currently undergoing analysis and evaluation. G.Y.

N79-25015*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MULTIVARIABLE CONTROL ALTITUDE DEMONSTRATION ON THE F100 TURBOFAN ENGINE
B. Lehtinen, R. L. DeHoff (Systems Control, Inc., Palo Alto, Calif.), and R. D. Hackney (Pratt and Whitney Aircraft Group, West Palm Beach, Fla.) 1979 31 p refs Presented at the 15th Joint Propulsion Conf., Las Vegas, Nev., 18-20 Jun. 1979; sponsored by AIAA, Soc. of Automotive Engr., and ASME (NASA-TM-79183; E-050) Avail: NTIS HC A03/MF A01 CSCL 21E

The F100 Multivariable control synthesis (MVCS) program, was aimed at demonstrating the benefits of LGR synthesis theory in the design of a multivariable engine control system for operation throughout the flight envelope. The advantages of such procedures include: (1) enhanced performance from cross-coupled controls, (2) maximum use of engine variable geometry, and (3) a systematic design procedure that can be applied efficiently to new engine systems. The control system designed, under the MVCS program, for the Pratt & Whitney F100 turbofan engine is described. Basic components of the control include: (1) a reference value generator for deriving a desired equilibrium state and an approximate control vector, (2) a transition model to produce compatible reference point trajectories during gross transients, (3) gain schedules for producing feedback terms appropriate to the flight condition, and (4) integral switching logic to produce acceptable steady-state performance without engine operating limit exceedance. J.A.M.

N79-25016*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FUNDAMENTALS OF GAS TURBINE COMBUSTION
Melvin Gerstein (Univ. of Southern Calif., Los Angeles) 1979 52 p Workshop held at Cleveland, 6-7 Feb. 1979 (NASA-CP-2087; E-026) Avail: NTIS HC A04/MF A01

CSCL 21E

Combustion problems and research recommendations are discussed in the areas of atomization and vaporization, combustion chemistry, combustion dynamics, and combustion modelling. The recommendations considered of highest priority in these areas are presented. S.E.S.

N79-25017*# Williams Research Corp., Walled Lake, Mich.
ADVANCED GENERAL AVIATION TURBINE ENGINE (GATE) CONCEPTS Final Report
E. J. Lays and G. L. Murray 26 Jun. 1979 189 p refs
(Contract NAS3-20758)
(NASA-CR-159603; WRC-78-113-15) Avail: NTIS HC A09/MF A01 CSCL 21E

Concepts are discussed that project turbine engine cost savings through use of geometrically constrained components designed for low rotational speeds and low stress to permit manufacturing economies. Aerodynamic development of geometrically constrained components is recommended to maximize component efficiency. Conceptual engines, airplane applications, airplane performance, engine cost, and engine-related life cycle costs are presented. The powerplants proposed offer encouragement with respect to fuel efficiency and life cycle costs, and make possible remarkable airplane performance gains. M.M.M.

N79-25018*# Solar Turbines International, San Diego, Calif.
INTERNALLY COATED AIR-COOLED GAS TURBINE BLADING Final Report, Aug. 1977 - Dec. 1978
L. Hsu, W. G. Stevens, and A. R. Stetson Mar. 1979 102 p refs
(NASA-CR-159574; SR79-R-4655-15) Avail: NTIS HC A06/MF A01 CSCL 21E

Ten candidate modified nickel-aluminide coatings were developed using the slip pack process. These coatings contain additives such as silicon, chromium and columbium in a nickel-aluminum coating matrix with directionally solidified MAR-M200 + Hf as the substrate alloy. Following a series of screening tests which included strain tolerance, dynamic oxidation and hot corrosion testing, the Ni-19A1-1Cb (nominal composition) coating was selected for application to the internal passages of four first-stage turbine blades. Process development results indicate that a dry pack process is suitable for internal coating application resulting in 18 percent or less reduction in air flow. Coating uniformity, based on coated air-cooled blades, was within + or - 20 percent. Test results show that the presence of additives (silicon, chromium or columbium) appeared to improve significantly the ductility of the NiA1 matrix. However, the environmental resistance of these modified nickel-aluminides were generally inferior to the simple aluminides. A.R.H.

N79-25019*# Notre Dame Univ., Ind.
TIME OPTIMAL CONTROL OF A JET ENGINE USING A QUASI-HERMITE INTERPOLATION MODEL M.S. Thesis
John G. Comiskey May 1979 171 p refs
(Grant NsG-3048)
(NASA-CR-158711; EE-791) Avail: NTIS HC A08/MF A01 CSCL 21E

This work made preliminary efforts to generate nonlinear numerical models of a two-spooled turbofan jet engine, and subject these models to a known method of generating global, nonlinear, time optimal control laws. The models were derived numerically, directly from empirical data, as a first step in developing an automatic modelling procedure. J.A.M.

N79-25020*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
DESIGN STUDY AND PERFORMANCE ANALYSIS OF A HIGH-SPEED MULTISTAGE VARIABLE-GEOMETRY FAN FOR A VARIABLE CYCLE ENGINE Final Report
T. J. Sullivan and D. E. Parker Mar. 1979 228 p refs
(Contract NAS3-20041; R79AEG288)
(NASA-CR-159545) Avail: NTIS HC A11/MF A01 CSCL 21E

A design technology study was performed to identify a high speed, multistage, variable geometry fan configuration capable of achieving wide flow modulation with near optimum efficiency at the important operating condition. A parametric screening study of the front and rear block fans was conducted in which the influence of major fan design features on weight and efficiency was determined. Key design parameters were varied systematically to determine the fan configuration most suited for a double bypass, variable cycle engine. Two and three stage fans were considered for the front block. A single stage, core driven fan was studied for the rear block. Variable geometry concepts were evaluated to provide near optimum off design performance. A detailed aerodynamic design and a preliminary mechanical design were carried out for the selected fan configuration. Performance predictions were made for the front and rear block fans. Author

N79-25021*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INTERFERENCE EFFECTS OF AIRCRAFT COMPONENTS ON THE LOCAL BLADE ANGLE OF ATTACK OF A WING-MOUNTED PROPELLER
J. P. Mendoza Jun. 1979 43 p refs
(NASA-TM-78587; A-7812) Avail: NTIS HC A03/MF A01 CSCL 01C

The aerodynamic interference effects on a propeller operating in the presence of different wing-body-nacelle combinations was studied. The unsteady blade angle of attack variation with azimuth angle by varying the pitch and yaw of the nacelle was minimized. Results indicate for the particular configuration of interest the minimum blade angle of attack variation occurred with the nacelle pitched downward 4.5 deg and yawed inward 3.0 deg. S.E.S.

N79-25022*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OPERATING CONDITION AND GEOMETRY EFFECTS ON LOW-FREQUENCY AFTERBURNER COMBUSTION INSTABILITY IN A TURBOFAN AT ALTITUDE
Richard R. Cullom and Roy L. Johnsen Jun. 1979 31 p refs
(NASA-TP-1475; E-9886) Avail: NTIS HC A03/MF A01 CSCL 21E

Three afterburner configurations were tested in a low-bypass-ratio turbofan engine to determine the effect of various fuel distributions, inlet conditions, flameholder geometry, and fuel injection location on combustion instability. Tests were conducted at simulated flight conditions of Mach 0.75 and 1.3 at altitudes from 11,580 to 14,020 m (38,000 to 46,000 ft). In these tests combustion instability with frequency from 28 to 90 Hz and peak-to-peak pressure amplitude up to 46.5 percent of the afterburner inlet total pressure level was encountered. Combustion instability was suppressed in these tests by varying the fuel distribution in the afterburner. Author

N79-25023*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INDUSTRY TESTS OF NASA CERAMIC THERMAL BARRIER COATING
Curt H. Liebert and Francis S. Stepka Jun. 1979 26 p refs
Presented at 6th Intern. Vacuum Metallurgy Conf., San Diego, Calif., 23-27 Apr. 1979; Sponsored by Am. Vacuum Soc.
(NASA-TP-1425; E-9846) Avail: NTIS HC A03/MF A01 CSCL 21E

Ceramic thermal barrier coating (TBC) system was tested by industrial and governmental organizations for a variety of aeronautical, marine, and ground-based gas turbine engine applications. This TBC is a two-layer system with a bond coating of nickel-chromium-aluminum-yttrium (Ni-16Cr-6Al-0.6Y, in wt. percent) and a ceramic coating of yttria-stabilized zirconia (ZrO_2-12Y_2O_3, in wt. percent). Seven tests evaluated the system's thermal protection and durability. Five other tests determined thermal conductivity, vibratory fatigue characteristics, and corrosion resistance of the system. The information presented includes test results and photographs of the coated parts. Recommendations are made for improving the coating procedures. J.M.S.

N79-25024*# Douglas Aircraft Co., Inc., Long Beach, Calif.
SIMULATED PROPELLER SLIPSTREAM EFFECTS ON A SUPERCRITICAL WING
H. Robert Welge and James P. Crowder Jun. 1978 72 p refs
(Contract NAS2-9472)
(NASA-CR-152138) Avail: NTIS HC A04/MF A01 CSCL 21E

To quantify the installed performance of high speed (M = 0.8) turboprop propulsion systems, an experimental program designed to assess the magnitude of the aerodynamic interference of a propeller slipstream on a supercritical wing has been conducted. The test was conducted in the NASA Ames 14-foot wind tunnel. An ejector-nacelle propeller slipstream simulator was used to produce a slipstream with characteristics typical of advanced propellers presently being investigated. A supercritical wing-body configuration was used to evaluate the interference effects. A traversing total pressure rake was used to make flow field measurements behind the wing and to calibrate the slipstream simulator. The force results indicated that the interference drag amounted to an increase of ten counts or about 3% of the wing-body drag for a two engine configuration at the nominal propeller operating conditions. However, at the higher swirl angles (11 deg vs. 7 deg nominally) the interference drag was favorable by about the same magnitude. Author

N79-25025# ARO, Inc., Arnold Air Force Station, Tenn.
OPTICAL IN SITU VERSUS PROBE MEASUREMENTS OF NITRIC OXIDE CONCENTRATION AS A FUNCTION OF AXIAL POSITION IN A COMBUSTOR EXHAUST Final Report, 21 Jul. - 27 Aug. 1977
J. D. Few, R. J. Bryson, and H. S. Lowry, III AEDC Mar. 1979 37 p refs
(AD-A067329; AEDC-TR-78-32) Avail: NTIS HC A03/MF A01 CSCL 21/2

Nitric oxide (NO) concentration was measured at three axial stations (6.5, 12, and 25 nozzle diameters downstream of a combustor nozzle exit) in a jet engine combustor exhaust by a gas-sampling probe in conjunction with conventional gas analyzers and an optical resonance absorption technique. The gas analyzer system permitted measurements of NO, NO sub x, CO, CO sub 2, and C sub x, H sub y (total hydrocarbons) whereas the optical absorption technique permitted measurement of NO only. The combustor was exhausted into a test cell of slightly less than atmospheric pressure and was operated at an inlet air temperature of 589 K, a total pressure of 344.3 kPa, and a fuel-to-air ratio (f/a) of 0.02. A multiprobe rake was used to acquire emissions, total pressure and temperature, and static pressure data at the measurement stations. The measurements of total pressure, total temperature, and measured static pressure were used to determine static temperature and pressure profiles at each measurement station, which are required for determining NO concentration by the optical absorption technique. GRA

N79-25026# Calspan Corp., Buffalo, N. Y.
BLAST INDUCED DISTORTION EXPERIMENTS ON AN ENGINE INLET Final Report, Feb. 1977 - Jan. 1978
Albert O. Davis and Michael G. Dunn 30 Jan. 1978 73 p refs
(Contract DNA001-77-C-0097)
(AD-A066811; AD-E300477; DNA-4513F) Avail: NTIS HC A04/MF A01 CSCL 20/4

This report briefly reviews the results of the Kaman AviDyne/AEDC experimental program funded by DNA. The purpose of this program was to develop an experimental technique that could be used to define the nuclear-blast-induced distortion at the inlet/engine interface of aircraft and air-breathing missiles. The results of the test program have been evaluated as has the potential impact of these results on other air-breathing engines with inlets having different L/D values. Author (GRA)

N79-25027# Pratt and Whitney Aircraft, West Palm Beach, Fla. Government Products Div.
REGRESSION SIMULATION OF TURBINE ENGINE PERFORMANCE: ACCURACY IMPROVEMENT (TASK 4) Final Technical Report, 30 Sep. 1977 - 30 Sep. 1978
Joseph A. Sabatella, Jr. and James S. Johnson 30 Sep. 1978 96 p refs
(Contract F33615-77-C-2109)
(AD-A066398; PWA-FR-10608; AFAPL-TR-78-103) Avail: NTIS HC A06/MF A01 CSCL 21/5

The Regression Simulation of Turbine Engine Performance (RSTEP) Task IV program was an analytical study to identify and evaluate approaches to improve the accuracy of regression surfaces for use in TEVCS/ARES procedures. The Central Composite Design (CCD) data selection pattern was studied and found to be a flexible, accurate, and economical alternative to the orthogonal Latin Square design selector. The impact of the number of independent variables and the number of data points was systematically investigated. Two methodologies which provided significant improvement in the accuracy of the regression surfaces were also identified. Author (GRA)

N79-25028# AiResearch Mfg. Co., Phoenix, Ariz.
COMBUSTOR DESIGN CRITERIA VALIDATION. VOLUME 3: USER'S MANUAL Final Technical Report, 2 Jul. 1975 - 31 Oct. 1978
H. C. Mongia and R. S. Reynolds Feb. 1979 412 p refs
(Contract DAAJ02-75-C-0044)
(AD-A066793; AiResearch-75-211682(38)-3; USARTL-TR-78-55-C-Vol-3) Avail: NTIS HC A18/MF A01 CSCL 21/5

This document, the User's Manual, is Volume III of the Combustor Design Criteria Validation Program. It contains general information, descriptions of analytical models, descriptions of associated computer codes, and illustrations of the various combustor models. GRA

N79-25029# Ford Motor Co., Dearborn, Mich.
BRITTLE MATERIALS DESIGN, HIGH TEMPERATURE GAS TURBINE: CERAMIC TURBINE ROTOR TECHNOLOGY Interim Report, 1 Oct. 1977 - 31 Mar. 1978
Arthur F. McLean and Robert R. Baker Feb. 1979 87 p refs
(Contract DAAG46-71-C-0162)
(AD-A067176; AMMRC-TR-79-11; IR-13) Avail: NTIS HC A05/MF A01 CSCL 11/2

This report contains progress during the last six months and a summary of earlier progress on the DOE supported programs within the joint DARPA/DOE 'Brittle Materials Design, High Temperature Gas Turbine' Program and constitutes the final report of work under DOE funds. A separate report will cover the progress on the DARPA supported Ceramic Turbine Testing Program. The summary of previous work supported by DOE includes progress on reaction bonded and hot pressed silicon nitride materials technology. Several NDE techniques were considered for the detection of flaws in complex-shaped silicon nitride components. Improvements to the hot press bonding process resulted in a significant improvement in the yield of flaw-free hot press bonded rotors. M.O.R. and cold spin tests of rotor blade rings revealed the presence of undetected subsurface flaws in both the blades and the rim. Blade bend testing indicated that blade strength degraded during hot press bonding. During this reporting period, an investigation of hot press bonding temperatures and time at temperature defined a region of zero microstructural and strength degradation. This study involved 19 hot press bondings from which curves were generated defining the changes in color, porosity, hardness, phase and strength as a function of time and temperature. GRA

N79-25030# Central Electricity Research Labs., Leatherhead (England).
DEPOSITION OF SODIUM COMPOUNDS UNDER GAS TURBINE CONDITIONS European Concerted Action. COST 50 - Materials for Gas Turbines, Project UK-6. Final Report
J. W. Laxton, C. G. Stevens, and D. Tidy Mar. 1978 27 p refs
Avail: NTIS HC A03/MF A01

The deposition rate of sodium compounds on test surfaces in a deposition rig at temperatures, pressures, and gas velocities typical of those found in gas turbines was measured. Controlled levels of sodium impurity had been introduced into oil at concentrations up to 15 parts per million by weight as either oil-soluble sodium napthenate or oil-borne emulsions of aqueous sodium chloride or sodium sulphate. The results are compared with theoretical rates of deposition derived for three possible mechanisms. These are a vapor mass transfer mechanism in which partial conversion of the sodium species to sulphate occurs within the boundary layer at the blade surface, a particulate mass transfer of recondensed sodium sulfate from the bulk gas to the surface, the sulfate being formed in the bulk gas, and particulate mass transfer of unevaporated sodium species. The vapor mass transfer mechanism shows the highest degree of

concurrence betwen calculated and observed deposition rates.
Author (ESA)

N79-25031# National Technical Information Service, Springfield, Va.
CAVITATION. PART 4: CAVITATION FLOW AND EROSION IN TURBINES. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Feb. 1979
Guy E. Habercom, Jr. Apr. 1979 95 p Supersedes NTIS/PS-78/0261; NTIS/PS-77/0244; NTIS/PS-76/0167; NTIS/PS-75/295
(NTIS/PS-79/0330/5; NTIS/PS-78/0261; NTIS/PS-77/0244; NTIS/PS-76/0167; NTIS/PS-75/295) Avail: NTIS HC $28.00/MF $28.00 CSCL 21E

The cavitation flow characteristics and erosion processes involving turbopumps, turbine blades, and steam turbines are documented. Steam, liquid, and drop flow are investigated. Test facilities and methods are described, as well as statistical and theoretical information. The applications include rocket engines, cryopumps, and other hydraulic turbines. GRA

N79-25032# Vereinigte Edelstahlwerke A.G. Kapfenberg (Austria). Forschungsanstalt (TEK).
INVESTIGATION ON THE RELATION BETWEEN FORGING TECHNOLOGY, STRUCTURE AND PROPERTIES OF PRECISION FORGED BLADES AND OF STATIONARY GAS TURBINE DISKS European Concerted Action. COST 50 - Materials for Gas Turbines, Project A1. Final Report [UNTERSUCHUNG UEBER DEN ZUSAMMENHANG ZWISCHEN SCHMIEDETECHNOLOGIE, GEFUEGE UND EIGENSCHAFTEN VON PRAEZISIONSGESCHMIEDETEN SCHAUFELN SOWIE SCHEIBEN FUER STATIONAERE GASTURBINEN]
W. Mitter, F. Kreitner, and H. Tarmann 30 Dec. 1977 98 p refs In GERMAN
Avail: NTIS HC A05/MF A01

Mechanical and micrographic tests were performed on nickel base alloys (Nimonic, Inconel) which are frequently used in gas turbine construction. The hot torsion test was used to simulate the forging process, and hence, to establish a relationship between forging technology and microstructure of alloys. Microstructure and tensile strength at room and elevated temperatures were determined for precision forged and heat-treated turbine blades. High cycle fatigue tests and creep tests were carried out. J.A.M.

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N79-25033*# Oklahoma State Univ., Stillwater.
HANDLING QUALITIES OF LARGE FLEXIBLE CONTROL-CONFIGURED AIRCRAFT Semiannual Status Report, 1 Jan. - 30 Jun. 1979
Robert L. Swaim 22 Jun. 1979 10 p refs
(Grant NsG-4018)
(NASA-CR-158694) Avail: NTIS HC A02/MF A01 CSCL 01C

The approach to an analytical study of flexible airplane longitudinal handling qualities was to parametrically vary the natural frequencies of two symmetric elastic modes to induce mode interactions with the rigid body dynamics. Since the structure of the pilot model was unknown for such dynamic interactions, the optimal control pilot modeling method is being applied and used in conjunction with pilot rating method. J.A.M.

N79-25034*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
CAPTURING AND TRACKING PERFORMANCE OF THE HORIZONTAL GUIDANCE AND CONTROL SYSTEMS OF THE TERMINAL CONFIGURED VEHICLE
Charles E. Knox Jun. 1979 35 p refs
(NASA-TM-80068; L-11442) Avail: NTIS HC A03/MF A01 CSCL 01C

A twin-jet commercial transport equipped with digital navigation, guidance, and control systems and advanced electronic display system was used for airborne operational research. The results of flight tests which evaluated a second-order horizontal-path guidance control law and the autopilot and airplane response are presented. This evaluation was accomplished through analysis of recorded flight data and through pilot opinion of the airplane maneuvers during automatic path-capture scenarios and path tracking. Four different path captures were flown at a ground speed of approximately 160 knots and repeatec at approximately 300 knots. Path tracking tracking error was measured in terms of cross track error along two paths: one pat at cruise speeds and one at airport-terminal-area speeds. The path tracking accuracy and the smoothness of the airplane maneuvers were judged satisfactory for high speeds; however, at lower speeds the control law design should be improved so that tracking will be more accurate for operations in the airport terminal area.
J.M.S.

N79-25035# Systems Technology, Inc., Hawthorne, Calif.
ANALYSIS OF DIGITAL FLIGHT CONTROL SYSTEMS WITH FLYING QUALITIES APPLICATIONS. VOLUME 1: EXECUTIVE SUMMARY Final Report, Mar. 1977 - Jun. 1978
Richard F. Whitbeck Sep. 1978 28 p
(Contract F33615-77-C-3026; AF Proj. 2307)
(AD-A066809; STI-TR-1101-1-Vol-1; AFFDL-TR-78-115-Vol-1)
Avail: NTIS HC A03/MF A01 CSCL 01/3

Revisitation and extension of classical sampled data approaches for the analysis of discretely controlled continuous systems is the focus of this report. A review of basic linear analysis topics required to support later developments is given. These topics include Laplace, z- and advanced z-transform facts; partial fraction expansion; data holds and the switch decomposition technique. Extension of switch decomposition for the vector signal case is given. A new direct transform domain approach for analyzing two-rate sampled systems is developed. This approach also applies for multi-rate sampled systems in restricted circumstances. Utility of this approach resides in its operator notation and conventions for manipulation in connection with vector block diagram algebra. This, in turn, expedites development of pulse transfer functions and of response recursion relations for multivariable, closed-loop systems. This is accomplished without resorting to the more complicated switch decomposition method. Multi-rate sampling analysis procedures are used to sharpen the concept of 'frequency response' for discretely excited, continuous systems. All methods of analysis presented in this report are closed-form and exact in that no approximation is required in the mathematical development of any result. GRA

N79-25036# Systems Technology, Inc., Hawthorne, Calif.
ANALYSIS OF DIGITAL FLIGHT CONTROL SYSTEMS WITH FLYING QUALITIES APPLICATIONS. VOLUME 2: TECHNICAL REPORT Final Report, Mar. 1977 - Jun. 1978
Richard F. Whitbeck and L. G. Hofmann Sep. 1978 230 p refs
(Contract F33615-77-C-3026)
(AD-A067177; STI-TR-1101-1-Vol-2; AFFDL-TR-78-115-Vol-2)
Avail: NTIS HC A11/MF A01 CSCL 01/3

Revisitation and extension of classical sampled data approaches for the analysis of discretely controlled continuous systems is the focus of this report. A review of basic linear analysis topics required to support later developments is given. These topics include Laplace, z- and advanced z-transform facts; partial fraction expansion; data holds and the switch decomposition technique. Extension of switch decomposition for the vector signal case is given. The w'-domain is defined by a bilinear transformation of the z-domain. Properties of the w'-domain are developed. A new direct transform domain approach for analyzing two-rate sampled systems is developed This approach also applies for multi-rate sampled systems in restricted circumstances. Utility of this approach resides in its operator notation and conventions for manipulation in connection with vector block diagram algebra. This, in turn, expedites development of pulse transfer functions and of response recursion relations for multivariable, closed-loop systems. This is accomplished without resorting to the more complicated switch decomposition method. Multi-rate sampling analysis procedures are used to sharpen the concept of frequency response for discretely excited, continuous systems. Frequency

response, in this case, pertains to steady-state responses at the input frequency and its positive aliases. All methods of analysis presented in this report are closed-form and exact in that no approximation is required in the mathematical development of any result. GRA

N79-25037# Advisory Group for Aerospace Research and Development, Paris (France).
TECHNICAL EVALUATION REPORT ON THE 25TH GUIDANCE AND CONTROL PANEL SYMPOSIUM ON GUIDANCE AND CONTROL DESIGN CONSIDERATIONS FOR LOW ALTITUDE AND TERMINAL AREA FLIGHT
M. A. Ostgaard (AFFDL, Wright-Patterson AFB, Ohio) Mar. 1979 13 p Symp. held at Dayton, Ohio, 17-20 Oct. 1977
(AGARD-AR-129; ISBN-92-835-1316-9) Avail: NTIS

Lack of well defined operational concepts and requirements are outlined for the development efforts to fulfill low altitude operational needs and stimulate concepts that are cost effective. Crew workload which is the predominant factor in low altitude operation is discussed. The application of control technology to provide gust alleviation is presented. S.E.S.

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

N79-25038# Committee on Commerce, Science, and Transportation (U. S. Senate).
AIRCRAFT AND AIRPORT NOISE REDUCTION
Washington GPO 1978 402 p refs Hearings on S. 747, S. 3064 and H.R. 8729 before the Subcomm. on Aviation of the Comm. on Commerce Sci., and Transportation, 95th Congr., 2d Sess., 24-25 May, 13-14, 17 Jun. 1978
(GPO-29-661) Avail: Subcomm. on Aviation

Aircraft and airport noise was investigated at a Congressional hearing to try to provide mechanisms through which air carriers could comply with FAA noise reduction regulations. The possibility of guarantees was discussed as a mechanism. Airport planning and land acquisition were also discussed. R.E.S.

N79-25039*# Royal Aircraft Establishment, Bedford (England). Structures Dept.
SOME REMARKS ON THE DESIGN OF TRANSONIC TUNNELS WITH LOW LEVELS OF FLOW UNSTEADINESS
Dennis G. Mabey Washington NASA Aug. 1976 20 p refs (NASA Order L-32158-A)
(NASA-CR-2722) Avail: NTIS HC A02/MF A01 CSCL 01E

The principal sources of flow unsteadiness in the circuit of a transonic wind tunnel are presented. Care must be taken to avoid flow separations, acoustic resonances and large scale turbulence. Some problems discussed are the elimination of diffuser separations, the aerodynamic design of coolers and the unsteadiness generated in ventilated working sections. S.E.S.

N79-25040# Transportation Systems Center, Cambridge, Mass.
THE AIRPORT PERFORMANCE MODEL. VOLUME 1: EXTENSIONS, VALIDATIONS, AND APPLICATIONS Final Report, Jan. 1975 - Jun. 1976
J. Bellantoni, H. Condell, I. Englander, L. Fuertes, and J. Schwenk Oct. 1978 285 p refs
(AD-A062863; TSC-FAA-78-21-1) Avail: NTIS HC A13/MF A01 CSCL 01/5

A comput4er simulation of airport delay and congestion was prepared to help evaluate the benefit of capacity-related investments in the nation's airports. The model which has a data base comprising 31 high density airports, estimates dollar benefits to passengers and aircraft operators or delay reduction in landing, takeoff and gate docking, and reduction in fuel consumed and pollutants emitted as well as required groundside facilities. The delay estimate from the model showed reasonably good agreement with data taken at JFK, LGA and EWR. It was used to evaluate proposed investments for Honolulu, Detroit and Charlotte, N. C. GRA

N79-25041# Vought Corp., Dallas, Tex.
AAES LABORATORY SIMULATOR REQUIREMENTS (A-7 AIRCRAFT) Final Report, 27 Sep. 1977 - 27 Dec. 1978
J. R. Perkins, D. E. Lautner, J. L. Jones, and A. J. Marek Sep. 1978 126 p refs
(Contract N62269-77-C-0377)
(AD-A066393; Rept-2-54100/8R-3510; NADC-77277-30) Avail: NTIS HC A07/MF A01 CSCL 01/3

This program was conducted for establishing requirements and developing specific design data for a hot bench mockup (simulator). The simulator system being developed is based on the Advanced Aircraft Electrical System (AAES) Prototype Design evolved by the Vought Corp. under contract N62269-75-C-0391. The simulator system will ultimately be used by NADC to provide a laboratory verification of the operation and performance of the AAES in an aircraft weapon system environment. The evolved simulation design is formulated around the TA-7C aircraft electrical and avionic systems and the general physical/installation constraints of the TA-7C forward and mid fuselage sections. The designs developed under this contract were limited to electrical-avionic system definition and design. Simulator structural, system installation and wire harness designs will be developed under a follow-on contract. The designs developed under this contract include the full application of the AAES technologies to the TA-7C electrical and avionic subsystem and systems. The AAES technologies include HVDC (High Voltage DC) power generation, SOSTEL (Solid State Electric Logic) power distribution and management, and AMUX (Avionic Multiplexing). GRA

N79-25042# Naval Training Equipment Center, Orlando, Fla.
MOTION IN FLIGHT SIMULATION: AN ANNOTATED BIBLIOGRAPHY Final Report, 30 Sep. 1977 - 30 Jun. 1978
Joseph A. Puig, William T. Harris, and Gilbert L. Ricard Jul. 1978 753 p refs
(AD-A061687; NAVTRAEQUIPC-IH-298) Avail: NTIS HC A99/MF A01 CSCL 05/9

In support of Project 7744 - Motion Drive Signals for Flight Simulators, a review of the literature concerning motion simulation was conducted. Abstracts were included for 682 references. A primary objective of this review was to compare data from the various studies to identify general trends on the effects of motion on performance and training. The publications were listed alphabetically by author, chronologically, and also grouped into eight major categories as follows: reviews and bibliographies; equipment descriptions; requirements; algorithms and drive techniques; effects of motion; evaluation; vertical motion, and cost effectiveness. Author (GRA)

N79-25043# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
OPTIMAL PLACEMENT OF REGIONAL FLIGHT SIMULATORS M.S. Thesis
David R. VanDenburg and Jon D. Veith Sep. 1978 98 p refs
(AD-A060450; AFIT-LSSR-18-78B) Avail: NTIS HC A05/MF A01 CSCL 05/9

Due to the depletion of petroleum resources and increasing aircraft operating costs, inflight simulators are assuming a larger role in aircrew training. Simultaneously, increased simulator acquisition and support costs have resulted in fewer simulator systems. Consequently, a regional simulator deployment plan is often used. This plan involves the placement of simulator systems at a number of central locations and transporting students to these locations to accomplish their required training. This research attempted to develop a mathematical model to assist in the placement decision. The model was developed, however, a suitable computer algorithm could not be found to solve the resulting equations. Consequently, a model was developed and used to provide suggested student allocation schedules for predetermined simulator location plans. It was concluded that mathematical techniques could be employed to assist in the placement decisions. In addition, it is believed that future

improvements in computer software could produce an algorithm capable of solving the model originally developed. Author (GRA)

N79-25044# Naval Air Development Center, Warminster, Pa. Systems Directorate.
DESIGN OF AN OFF-AXIS WIDE FIELD-OF-VIEW VISUAL DISPLAY SYSTEM FOR FLIGHT SIMULATORS Final Report
G. Terry Thomas and Robert L. Jones 1 Jan. 1979 126 p refs
(AD-A066530; NADC-79023-20) Avail: NTIS HC A07/MF A01 CSCL 01/4

This report describes the analysis and design of an off-axis wide field-of-view visual display system, including component specifications and structural drawings. A fabrication cost and schedule estimate is also presented. Author (GRA)

N79-25045# San Diego Aircraft Engineering, Inc., Calif.
TASK REPORT ON A ONE-HALF SCALE LABORATORY MODEL OF A RIGID-HOLD-DOWN SKIRT SYSTEM Interim Report
P. Sorensen May 1978 34 p
(Contract N62269-78-Q-5137; WF41411000)
(AD-A065170; SAE-78-016; NADC-79026-20) Avail: NTIS HC A03/MF A01 CSCL 01/5

A description of the recommended baseline rigid skirt hold-down system was presented. This report documents the design and construction of a one-half scale laboratory model of the baseline system. This model is needed to demonstrate the hold-down concept and to evaluate system performance and development risk. Model design criteria, operating conditions, dimensioned drawings and stress analyses are included in this report. GRA

N79-25046# Bunker-Ramo Corp., Wright-Patterson AFB, Ohio.
MULTIFUNCTION KEYBOARD IMPLEMENTATION STUDY Final Report, 1 Apr. 1976 - 11 Feb. 1977
Robert P. Bateman, John M. Reising, Emmett L. Herron, and Gloria L. Calhoun Dec. 1978 193 p refs
(Contract F33615-76-C-0013; AF Proj. 6190; AF Proj. 2049)
(AD-A066140; AFFDL-TR-78-197) Avail: NTIS HC A09/MF A01 CSCL 05/9

An aircraft which utilizes digital computers will require the use of multifunction controls and displays. Four different multifunction keyboard configurations were examined by pilots flying a simulated mission. Two of the configurations were located on the left side of the front instrument panel, while the remaining two were located on the right side console and/or the right side of the front instrument panel. The pilots performed communications, navigation and stores tasks using each configuration. The configurations also utilized two different types of hardware: projection switches and cathode ray tubes. GRA

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N79-25047*# General Electric Co., Arlington, Va. Space Div.
STATISTICAL CONSIDERATIONS IN DESIGN OF SPACELAB EXPERIMENTS
John Robinson 16 Oct. 1978 41 p refs
(Contract NAS9-15487)
(NASA-CR-160197; TIR-741-LSP-8012) Avail: NTIS HC A03/MF A01 CSCL 22A

After making an analysis of experimental error sources, statistical models were developed for the design and analysis of potential Space Shuttle experiments. Guidelines for statistical significance and/or confidence limits of expected results were also included. The models were then tested out on the following proposed Space Shuttle biomedical experiments: (1) bone density by computer tomography; (2) basal metabolism; and (3) total body water. Analysis of those results and therefore of the models proved inconclusive due to the lack of previous research data and statistical values. However, the models were seen as possible guides to making some predictions and decisions. R.E.S.

N79-25048*# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
PROCEEDINGS OF THE USAF/NASA INTERNATIONAL SPACECRAFT CONTAMINATION CONFERENCE Scientific Interim Report, 7-9 Mar. 1978
James M. Jemiola, ed. 1978 1219 p refs Conf. held at AF Acad., Colo., 7-9 Mar. 1978; cosponsored by NASA and AF (AF Proj. 7340)
(NASA-CP-2039; AFML-TR-78-190) Avail: NTIS HC A99/MF A01 CSCL 22A

Spacecraft modeling, determination of basic material properties, thruster plume characteristics and modeling are discussed along with contamination prevention and control and contamination kinetics and effects. For individual titles, see N79-25049 through N79-25087.

N79-25049*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
OUTGASSING OF MATERIALS IN THE SPACE ENVIRONMENT: A THERMOKINETIC APPROACH c27
T. A. Hughes *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 14-33 refs (For primary document see N79-25048 16-12)
Avail: NTIS HC A99/MF A01 CSCL 07C

Outgassing is related to basic chemical reaction kinetics, which provides a powerful tool for such estimations and also provides an insight to the basic mechanisms involved. The general equations of the total outgassing quantity are derived, as well as the outgassing rates, as functions of time and temperature. The results are shown to be consistent with experimental data. The power to the reaction kinetics approach lies in its applicability whether the outgassing mechanism is due to desorption, diffusion, thermal decomposition, or evaporation. It also illuminates those situations where only minor constituents of the parent material outgas, or where the entire substance may outgas. To implement the use of this approach certain thermokinetic parameters must be measured for each material of interest. It is suggested that the necessary data can be obtained through sensitive thermogravimetric analysis techniques. J.M.S.

N79-25050*# Aerojet Electrosystems Co., Azusa, Calif.
A MULTINODAL MODEL FOR SURFACE CONTAMINATION BASED UPON THE BOLTZMANN EQUATION OF TRANSPORT c23
E. A. Zeiner *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 14-33 refs (For primary document see N79-25048 16-12)
Avail: NTIS HC A99/MF A01 CSCL 07A

A composite analytical model to compute the deposition rates of volatile condensible materials (VCM) on the surfaces of a multinodal enclosure is derived. Features of the model include: (1) a Fick diffusion model for the VCM mass loss rates from the source material; (2) an exponential-Langmuir model to account for the reemission rates of deposited VCM; and (3) a Krook relaxation model of the Boltzmann equation to characterize the scattering and transport properties of the VCM between the enclosure nodes. J.M.S.

N79-25051*# Lockheed Missiles and Space Co., Palo Alto, Calif.
OUTGASSING RATE OF MULTILAYER INSULATION c24
A. P. M. Glassford and C. K. Liu *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 83-106 refs (For primary document see N79-25048 16-12)
Avail: NTIS HC A99/MF A01 CSCL 11D

Isothermal outgassing rate data were obtained for a range of temperatures for a selection of commonly-used multilayer insulation shields and spacers. An attempt was made to incorporate the data into various analytical models in order to estimate the rates for other constant or varying temperature situations. A technique based on collection of the outgas species on a cooled quartz crystal microbalance was used. The technique permits between one and three orders of magnitude better sensitivity and accuracy to be achieved, while variable sample temperature operation presents no additional problem. J.M.S.

N79-25052*# Martin Marietta Aerospace, Denver, Colo.
APPLICABILITY OF THERMOGRAVIMETRIC ANALYSIS TO

SPACE CONTAMINATION c18
J. A. Muscari, R. O. Rantanen, and N. J. Pugel (Denver Univ.) *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 107-117 refs (For primary document see N79-25048 16-12)
(Contract F33615-76-C-5212)
Avail: NTIS HC A99/MF A01 CSCL 22B

Application of isothermal thermogravimetry and dynamic thermogravimetry to the study of space contamination is considered in relation to the need for higher temperature data resulting from laser radiation impingement. Results of a dynamic thermogravimetric study are presented. Advantages and disadvantages of the two test methods are summarized. J.M.S.

N79-25053*# European Space Technology Center, Noordwijk (Netherlands). Product Assurance Div.
OUTGASSING MEASUREMENTS ON MATERIALS IN VACUUM USING A VACUUM BALANCE AND QUARTZ CRYSTAL BALANCES c18
A. Zwaal *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 118-150 refs (For primary document see N79-25048 16-12)
Avail: NTIS HC A99/MF A01 CSCL 22B

Outgassing systems using vacuum and quartz crystal balances are described. Arrhenius-type outgassing equations in which the outgassing is a function of temperature, activation energy, and time are discussed. Also described is a theoretical approach to spacecraft contamination. J.M.S.

N79-25054*# Martin Marietta Aerospace, Denver, Colo.
SPACELAB INDUCED ENVIRONMENT TECHNICAL OVERVIEW c16
L. E. Bareiss *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 152-175 refs (For primary document see N79-25048 16-12)
(Contract NAS8-31574)
Avail: NTIS HC A99/MF A01 CSCL 22B

A compilation of the results of a systems level contamination analysis and related computer modeling activities is presented. A technical assessment of the contamination problems anticipated during the Spacelab program and recommendations for contamination abatement designs are given along with operational procedures based upon experience gained in the field of contamination analysis and assessment dating back to the pre-Skylab era. J.M.S.

N79-25055*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INFRARED RADIATION FROM THE SPACE SHUTTLE CONTAMINANT ENVIRONMENT c18
J. P. Simpson and F. C. Witteborn *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 176-207 refs (For primary document see N79-25048 16-12)
(Contract NAS2-9636)
Avail: NTIS HC A99/MF A01 CSCL 22B

The space shuttle contaminant environment consisting of molecules and particles originating on the Shuttle is considered. The molecules come from outgassing, cabin leakage, flash evaporators and other man-controlled vents, and rocket exhaust. Particles are thought to come from abrasion, ablation of surfaces, dust trapped in cracks, dust from vents and cabin leaks, ice particles from improper venting, and droplets of unburned fuel. The effect of the infrared radiation from molecules and particles on a sensitive infrared telescope is emphasized. Infrared spectrum of H2O and CO2 at fairly high resolution is discussed along with the spectrum and sighting frequency of particles spalled by micrometeoroids. J.M.S.

N79-25056*# Aerojet Electrosystems Co., Azusa, Calif.
SPACECRAFT CONTAMINATION MODEL DEVELOPMENT c18
J. M. Millard and C. R. Maag *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 208-229 refs (For primary document see N79-25048 16-12)
(Contract F04701-76-C-0220)
Avail: NTIS HC A99/MF A01 CSCL 22B

The development and use of a contamination mathematical computer model that has application to any on-orbit spacecraft system is defined. The model is modular, consisting of several major subroutines. These routines consider outgassing, venting and leakage, and thruster engines and point sources. The heart of the model, an integration program, has three major elements that are integrated into concise sets of equations. The basic elements are source kinetics, transport mechanisms, and reemission kinetics. A correlation of the analysis with observed radiator degradation of a geosynchronous altitude satellite is presented to show the merit of the modeling approach. Author

N79-25057*# Aerojet Electrosystems Co., Azusa, Calif.
AN IMPROVED ANALYTIC TECHNIQUE TO PREDICT SPACE SYSTEM CONTAMINATION c18
R. R. Hale *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 230-249 refs (For primary document see N79-25048 16-12)
(Contract F04701-77-C-0010)
Avail: NTIS HC A99/MF A01 CSCL 22B

A mathematical model to predict diffusion mass transport among surfaces is described which accounts for inter-molecular collisional behavior. The mathematical characterization utilized dynamic thermal history behavior for the surface of interest. The instantaneous local atmospheric pressure prior to and during ascent to calculate molecular collision probabilities was investigated. Adsorption coefficients for various temperatures are evaluated for each surface in a manner which simulates their mission temperature cycles. The input data for this portion of the contamination model is developed from thermal models, and a sojourn time and accommodation coefficient description is applied to surface behavior. The model was used to predict net contamination conditions at insertion for a geosynchronous satellite launched on a Titan 34D vehicle. Output data from that analysis is presented and further applications to alternative launch techniques are reviewed. The parametric index which allows selection of either the diffusion or the line of sight contamination transport calculations, as appropriate to the mission instantaneous environment, is described. S.E.S.

N79-25058*# Old Dominion Univ., Norfolk, Va.
SHUTTLE FLOW FIELD ANALYSIS USING THE DIRECT SIMULATION MONTE CARLO TECHNIQUE c16
J. E. Hueser and F. J. Brock *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 250-273 refs (For primary document see N79-25048 16-12)
(Grant NsG-1271)
Avail: NTIS HC A99/MF A01 CSCL 22B

The geometrical configuration of the Shuttle surface elements written into the flow field analysis program code is described. The flow field configuration and the location of the Shuttle within the flow field is discussed. The density distribution, velocity distribution, and flux density are reported for different molecules. S.E.S.

N79-25059*# Aerojet Electrosystems Co., Azusa, Calif.
BACKFLOW CONTAMINATION FROM SOLID ROCKET MOTORS c20
C. R. Maag *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 332-346 refs (For primary document see N79-25048 16-12)
(Contract F04701-77-C-0010)
Avail: NTIS HC A99/MF A01 CSCL 21H

Contamination from plumes of solid rocket motors is reported for the anomalous temperature behavior of many spacecraft systems and subsystems. A number of spacecraft experimenters, designers, and solid rocket motor experts were surveyed. All systems and subsystems were subjected to SRM plume effluents. The results are particularly meaningful to those concerned with modeling the effects of solid rocket motors on critical spacecraft surfaces or on scientific experiments affected by molecular contamination. S.E.S.

N79-25060*# Aerojet Electrosystems Co., Azusa, Calif.
CONTAMINATION MECHANISMS OF SOLID ROCKET MOTOR PLUMES c20
M. K. Barsh, J. A. Jeffery, P. Brestyanszky, and K. J. Adams *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 347-384 refs (For primary document see N79-25048 16-12)

(Contract F04701-77-C-0010)
Avail: NTIS HC A99/MF A01 CSCL 21H

Charge separation, intra plume collision, and nozzle boundary layer effects mechanisms are presented. Analytical computer models describing those mechanisms were developed, and experimental verification of the phenomena were explored. S.E.S.

N79-25061*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CONTAMINATION AND HEAT TRANSFER PROBLEMS RESULTING FROM HIGH EXPANSION OF THE SUBSONIC BOUNDARY LAYER FLOW IN THE VOYAGER TE-M-364-4 SOLID ROCKET MOTOR **c34**
Charles J. Leising and Morris L. Greenfield *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 385-400 ref (For primary document see N79-25048 16-12)
(Contract NAS7-100)
Avail: NTIS HC A99/MF A01 CSCL 20D

The flow from the subsonic boundary layer overheating and contaminating the instrument surfaces was studied. Estimates indicated that plume shields would have to be employed. The mass flux was calculated. The buildup of flow along the plume shield surface and the amount that would flow around the edge of the shield and impinge on the instruments was measured. The plume model, applicable MOLSINK test results, the TRW predictions and the Block 5 and Voyager flight results are discussed. S.E.S.

N79-25062*# Marquardt Corp., Van Nuys, Calif.
SPACE SHUTTLE PLUME CONTAMINATION **c16**
R. Carl Stechman *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 401-411 refs (For primary document see N79-25048 16-12)
Avail: NTIS HC A99/MF A01 CSCL 22B

Earth storable bipropellant propulsion systems for attitude control and orbit change maneuvers were used in the Space Shuttle Orbiter. The plume contamination potential for the primary and vernier thrusters of the Space Shuttle Orbiter were studied. Results indicate that plume transported contamination does not impinge or condense on the surfaces of the Orbiter, but some potential does exist for the flow of fuel film contaminant down the wall of the exhaust nozzle and off of the nozzle lip when short pulse widths and cold combuster walls are encountered. Contamination of Space Shuttle deployed payloads will be negligible since only the vernier thrusters are operated during this portion of the mission. The high performance of these engines will result in negligible plume contamination regardless of their orientation. S.E.S.

N79-25063*# ARO, Inc., Arnold Air Force Station, Tenn.
IR OPTICAL PROPERTIES OF BIPROPELLANT CRYOCONTAMINANTS **c28**
J. A. Roux, B. E. Wood, A. M. Smith, J. G. Pipes, and H. E. Scott (AEDC) *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 412-455 refs (For primary document see N79-25048 16-12)
Avail: NTIS HC A99/MF A01 CSCL 21I

The infrared spectral transmittance of cryodeposits and exhaust plume products was measured. Transmission spectra were obtained for the 500 to 3700 wave number range using the Fourier transform spectrometer. The optical properties are used for predicting the degration of plume contaminated cryocooled optical surface. Values of the complex index of refraction were derived from analytical model in conjunction with nonlinear least squares method. S.E.S.

N79-25064*# ARO, Inc., Arnold Air Force Station, Tenn.
EXHAUST PLUME CONTAMINANTS FROM AN AGED HYDRAZINE MONOPROPELLANT THRUSTER **c20**
T. D. McCay, D. P. Weaver, W. D. Williams, H. M. Powell, and J. W. L. Lewis *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 456-517 refs (For primary document see N79-25048 16-12)
Avail: NTIS HC A99/MF A01 CSCL 21H

Research on a 0.44 N hydrazine monopropellant thruster was performed to characterize the gas dynamic and contamination properties of the exhaust. Exhaust diagnostic systems included a mass spectrometer probe, a quartz crystal microbalance (QCM), a laser-Raman/Rayleigh system, an electron beam which permitted fluorescence measurements and flow visualization, and a particle collector. Plume species number densities and rotational temperatures were determined along with mass deposition rates at various QCM cryogenic surface temperatures. The contamination measurements made using the mass spectrometer probe and QCM show the variation of species mole fractions and deposition rates with pulse number and operating condition along with the associated engine performance values. An increase in hydrazine concentrations in the plume was observed to occur at a point in time without significant loss of engine performance. M.M.M.

N79-25065*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DESIGN OF A PROPULSION SYSTEM TEST FACILITY TO STUDY ROCKET PLUMES IN THE SPACE ENVIRONMENT **c20**
L. F. Molinari *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 518-532 refs (For primary document see N79-25048 16-12)
(Contract NAS7-100)
Avail: NTIS HC A99/MF A01 CSCL 21H

The propulsion contamination effects module space experiment used to measure exhaust plume characteristics and surface impingement effects from high thrust chemical and low thrust electric thrusters is described. The ability of analytical models to predict forces, heat fluxes, surface charging effects, and levels of contamination which are encountered by a spacecraft employing these thrusters is described. M.M.M.

N79-25066*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SHUTTLE INDUCED ENVIRONMENT CONTAMINATION MONITOR **c18**
Edgar R. Miller *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 534-566 refs (For primary document see N79-25048 16-12)
Avail: NTIS HC A99/MF A01 CSCL 14B

The induced environment contamination monitor (IECM) is a set of ten instruments integrated into a self-contained unit. The IECM is scheduled to fly as part of the Demonstration Flight Instrumentation on shuttle orbital flight tests 1 through 6 and on Spacelabs 1 and 2 as part of the verification flight instrumentation. The IECM is set to operate during prelaunch, ascent, on-orbit, descent, and post landing in measuring the actual environments to determine whether the controls placed on the shuttle system solved the contamination problem. M.M.M.

N79-25067*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MASS SPECTROMETER FOR IECM. PART 1: DESCRIPTION. PART 2: MEASUREMENT CONCEPTS **c35**
R. C. Ruff, D. R. Taeusch (Mich. Univ., Ann Arbor), W. A. Oran, and T. Rathz *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 567-604 refs (For primary document see N79-25048 16-12)
Avail: NTIS HC A99/MF A01 CSCL 14B

A conceptual simulation of the in situ measurements of a mass spectrometer is presented as well as a discussion of how the expected backscattering is related to the column density and the kinematics of the scattering process. M.M.M.

N79-25068*# Faraday Labs., Inc., La Jolla, Calif.
QUARTZ CRYSTAL MICROBALANCE SYSTEMS FOR SHUTTLE CONTAMINATION MEASUREMENTS **c35**
D. McKeown and C. R. Claysmith *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 605-628 refs (For primary document see N79-25048 16-12)
(Contract NAS8-32110)
Avail: NTIS HC A99/MF A01 CSCL 14B

Two different types of temperature controlled quartz crystal microbalance systems using passive and active cooling are described. The active system features thermoelectric devices for automatic temperature control and measures volatile and low volatile contaminants. M.M.M.

N79-25069*# Berkeley Controls, Inc., Irvine, Calif.
CONSIDERATIONS IN THE USE OF QCMs FOR ACCURATE CONTAMINATION MEASUREMENT **c35**

D. A. Wallace *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 14-33 refs (For primary document see N79-25048 16-12)
Avail: NTIS HC A99/MF A01 CSCL 14B

The flow equations involved in quartz crystal microbalance molecular mass flux measurement, the effect of parameters such as crystal temperature, QCM entrance configuration and randomness of the flow are examined as well as the implications of these equations in measuring several materials' mass flux. M.M.M.

N79-25070*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EVALUATING A CONTAMINATION HAZARD WITH A RESIDUAL GAS ANALYZER **c35**
Raymond Kruger *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 644-656 refs (For primary document see N79-25048 16-12)
Avail: NTIS HC A99/MF A01 CSCL 14B

A residual gas analyzer (RGA) used to monitor the partial pressure of a suspect contaminant material during the bake-out of a vacuum chamber and during the following test operation which involved a sensitive spacecraft instrument is described. A method for estimating the RGA sensitivity to the contaminant is presented. It is conservative from the standpoint of assessing the contamination hazard arising from the material in question. A cold finger technique that provides a surface on which residual gases can condense is described. Data from the cold finger showed that the sensitive test item was not contaminated. M.M.M.

N79-25071*# Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn (West Germany).
MOLECULAR CONTAMINATION STUDIES BY MOLECULAR BEAM SCATTERING **c72**
H. Nuss *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 657-681 refs (For primary document see N79-25048 16-12)
HC A99/MF A01 CSCL 20H

The capability of molecular beam scattering from a solid surface for identification of molecular contamination of the surface was studied. The experimental approach using a thermal molecular beam source, a phase sensitive measuring technique, and a vapor effusion source for defined contaminant application are described. The scattering distribution measured for a N2 molecular beam interacting with a Platinum surface were measured for clean and those conditions contaminated by diffusion pump oil DC 705. An expression for the equilibrium of adsorption and desorption rate was derived. Comparing the measured dependency of the molecular beam intensity from surface temperature with the theoretically derived formula for the surface coverage offers a method to determine the desorption energy. Author

N79-25072*# Arnold Engineering Development Center, Arnold Air Force Station, Tenn.
BIPROPELLANT ENGINE PUMP STUDY **c20**
H. E. Scott, D. F. Frazine, and E. G. Lund (Air Force Rocket Propulsion Lab., Edwards AFB, Calif.) *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 682-740 refs (For primary document see N79-25048 16-12)
Avail: NTIS HC A99/MF A01 CSCL 21H

Data from the first phase of an experimental program to characterize the exhaust properties of a liquid bipropellant engine under vacuum conditions are presented and discussed. Emphasis is placed on measurements of the mass flux in the plume backflow region of a 5 lbf bipropellant thruster at angles up to 150 degrees with respect to the plume centerline using temperature compensated quartz crystal microbalances (QCMs). The measurements were conducted in a high vacuum cryogenic chamber. The addition of new GHe and LHe cryopanels provided a blank-off pressure in the 0.0000001 torr range and maintained the background pressure in the 0.00001 torr range while pulse firing the motor (25-100 msec pulse width, 1-10 percent duty cycle). Chamber recovery time was a few tenths of a second. Several engine configurations were tested at different operating conditions so as to characterize exhaust properties and to investigate potential contamination effects. Author

N79-25073*# Aerojet Electrosystems Co., Azusa, Calif.
GROUND CONTAMINATION MONITORING METHODS **c20**
C. R. Maag and R. R. Scott *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 741-762 refs (For primary document see N79-25048 16-12)
Avail: NTIS HC A99/MF A01 CSCL 20H

Instrumentation and techniques for determining surface contamination on optical and thermal control surfaces are discussed. Two types of monitoring methods are described, Internal Reflection Spectroscopy and Front Surface Quarter Wave Coated Dielectric Mirrors. IRS measurements of a KRS-5 prism from 2.5 to 30 microns allows determination of contamination film thickness, calculation of real and imaginary index of refraction, and general species identification via refractive index signature analysis. Changes in solar absorptance and real index of refraction signature can be derived from the mirror measurements. A detailed description of the measurement techniques, along with sample spectra of deposited contaminants from a solid rocket motor test firing is presented. Author

N79-25074*# Boeing Aerospace Co., Seattle, Wash. Quality Assurance Labs.
ASSEMBLAGE ANALYSIS: IDENTIFICATION OF CONTAMINATION SOURCES **c25**
E. R. Crutcher *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 763-778 refs (For primary document see N79-25048 16-12)
Avail: NTIS HC A99/MF A01 CSCL 07D

Sources are identified as belonging to one of four major categories: autogenerated, function-generated, facility-generated, or activity-generated. The basis for criteria used to identify an assemblage and the analytical support required to evaluate such a sample is presented. Examples of common assemblages are given as well as precautions against conclusions based on too few members of an assemblage. A brief final statement is included regarding the benefits of this type of program support. G.Y.

N79-25075*# General Electric Co., Philadelphia, Pa. Re-entry and Environmental Systems Div.
SPACE GRADE CHEMICALLY FOAM SILICONE ELASTOMERS **c27**
Arnold A. Hiltz *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 781-808 (For primary document see N79-25048 16-12)
Avail: NTIS HC A99/MF A01 CSCL 07C

Space grade chemically foamed elastomers are prepared by subjecting the foams prepared from conventional silicones to a thermal vacuum stripping exposure after the normal cure and postcure treatments. The resulting foams meet all the weight loss and volatile condensible materials criteria required for a space grade material. They are much more economical to prepare than would be the forms prepared from the space grade silicones as starting materials. They possess physical and thermal properties similar to or superior to those foams which were not given the stripping treatment. G.Y.

N79-25076*# ARO, Inc., Arnold Air Force Station, Tenn.
ALUMINUM OXIDE PARTICLES PRODUCED BY SOLID ROCKET MOTORS **c20**
R. Dawbarn *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 809-845 refs (For primary document see N79-25048 16-12)
Avail: NTIS HC A99/MF A01 CSCL 21H

The candidate propellant for the Shuttle solid rocket motors contains approximately 16 percent aluminum powder. In this percentage range the aluminum can be considered as a significant portion of the fuel and it also tends to stabilize the burning rate process. There is a considerable source of data concerning metal oxide particles produced by solid propellant rocket motors. Before embracing these data and applying them to environmental and contamination concerns posed by Shuttle operations, awareness should be made of the prime interest which prompted these studies. With this in mind, the following topics are addressed: (1) damping combustion instabilities; (2) comparison of Al2O3 particle size data; (3) Al2O3 sampling techniques; (4) results from the Marshall Space Flight Center sampling tests; and (5) aluminum combustion. G.Y.

N79-25077*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
EFFECTIVENESS OF THE SHUTTLE ORBITER PAYLOAD BAY LINER AS A BARRIER TO MOLECULAR CONTAMINATION FROM HYDRAULIC FLUIDS **c18**
R. G. Richmond and R. M. Kelso *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 846-862 refs (For primary document see N79-25048 16-12)
Avail: NTIS HC A99/MF A01 CSCL 22B

One method of controlling contamination in the payload bay is the Shuttle Orbiter payload bay liner. The lower half of the Shuttle Orbiter payload bay inboard cavity has a liner consisting of a Teflon-coated Beta glass. Investigations were conducted to determine the effectiveness of the payload bay liner and filter material to serve as barriers to hydraulic fluids if spills or leaks occur in the fluid lines. The specific objectives of these studies were: (1) measure the transmission rate of the fluids through representative samples of the liner and filter material; (2) measure the relative condensation coefficient for the fluid; and (3) measure desorption rates for the hydraulic oil from contamination sensors. The results of the experiments are presented and discussed. G.Y.

N79-25078*# Union Carbide Corp., New York. Electronics Div.
PARTICULATE CONTAMINATION: TIE-DOWN WITH PARYLENE C **c27**
W. E. Loeb *In* AFML Proc. of USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 863-879 refs (For primary document see N79-25048 16-12)
Avail: NTIS HC A99/MF A01 CSCL 11C

Entrainment of loose conductive particles within microcircuit packages was documented as a persistent problem. A positive solution, employed successfully for NASA's Centaur electronics and under evaluation by military agencies, involves a plastic coating, Parylene C. At a thickness of 0.1 mil this material effectively encapsulates and seals (ties down) the offending particles in place, preventing further movement to positions causing electrical malfunctions. The Parylene coats and, thus, insulates all sufaces inside the package so that larger particles, should they break loose, cannot impair electrical performance. Process details are presented. Compatability of Parylene C coatings with active and most passive devices were demonstrated. Documentation of these and the exceptions are given. G.Y.

N79-25079*# Air Force Geophysics Lab., Hanscom AFB, Mass.
AFGL INFRARED SURVEY EXPERIMENTS CLEANING PROCEDURE **c74**
Charles V. Cunniff *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 880-898 refs (For primary document see N79-25048 16-12)
Avail: NTIS HC A99/MF A01 CSCL 20F

Spaceborne cryogenically cooled infrared telescope systems are optically sensitive to particulate contamination along the line-of-sight. Methods of cleaning and handling flight instrumentation were developed and used on the Infrared Celestial Survey program. These procedures are described in detail and flight results are presented. G.Y.

N79-25080*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PARTICULATE CONTAMINATION CONTROL FOR THE VIKING AND VOYAGER UNMANNED PLANETARY SPACECRAFT **c15**
Alan R. Hoffman and Robert C. Koukol *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 899-926 ref (For primary document see N79-25048 16-12)
(Contract NAS7-100)
Avail: NTIS HC A99/MF A01 CSCL 22B

Several qualitative and quantitative particulate monitoring methods applied during the Viking and Voyager programs provided data for assessing the adequacy of the air delivered to the spacecraft and resulted in visually clean spacecraft at encapsulation/launch and no in-flight anomalies attributable to particles. The qualitative methods included visual inspections of spacecraft surfaces with and without magnifying aids and the collection of particles for chemical or physical analysis. The quantitative methods were based on the utilization of light scattering monitors for enumerating the number of dust particles in a given volume of air. Monitoring both the inlet and exhaust air after encapsulation provided enhanced assurance that the spacecraft remained in a clean condition during transport and on-pad operations. Disc samples were a useful tool for collecting particulates for qualitative evaluation when it was appropriate to identify the source of the particles. A.R.H.

N79-25081*# Aerojet Electrosystems Co., Azusa, Calif.
THE 2ND SURFACE MIRROR CLEANING AND VERIFICATION **c74**
M. K. Barsh *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 927-944 refs (For primary document see N79-25048 16-12)
Avail: NTIS HC A99/MF A01 CSCL 20F

An effective cleaning procedure was established for second surface-thermal-control mirrors using Auger electron spectroscopy to measure the contaminant residues on variously cleaned mirror panels. It was subsequently found that two sequential cleaning operations performed on individual mirror elements after the visual clarity condition was obtained would achieve a minimal contamination level of less than 20 A on the mirrors. In addition, a post-cleaning wipe-and-extraction procedure provided a means of verifying the level of cleanliness achieved. These techniques are currently employed to provide maximum second surface-mirror cleanliness at launch described. A.R.H.

N79-25082*# Colorado State Univ., Fort Collins.
PUNCTURE DISCHARGES IN SURFACE DIELECTRICS AS CONTAMINANT SOURCES IN SPACECRAFT ENVIRONMENTS **c33**
E. J. Yadlowsky, R. C. Hazelton, and R. J. Churchill *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 945-969 refs (For primary document see N79-25048 16-12)
(Grant NSG-3145)
Avail: NTIS HC A99/MF A01 CSCL 09C

The spacecraft charging phenomenon was simulated in a laboratory vacuum chamber by irradiating suitable dielectric targets with an electron beam operating at accelerating potentials from 0-34 kV. In addition to static measurements and photographic examination of the puncture discharges in Teflon samples, the transient characteristics of the electrical discharges were determined from oscillographs of voltage and current and by charged particle measurements employing a biased Faraday cup and a retarding potential analyzer. Using these latter techniques, studies of angular and energy distributions of charged particles indicate an initial burst of high energy electrons (5 x 10 to the 13th power per discharge at energies greater than 3000 eV) followed by a less intense burst of lower energy negative particles. Positive ions are emitted from the discharge site in an initial high velocity burst followed by a lower velocity burst tentatively identified as carbon. A.R.H.

N79-25083*# ARO, Inc., Arnold Air Force Station, Tenn.
SPACECRAFT TEST CHAMBER CONTAMINATION STUDY, AEDC MARK 1 FACILITY **c14**
J. G. Pipes, D. F. Frazine, R. P. Young, E. N. Borson (Aerospace Corp., El Segundo, Calif.), and L. H. Rachal (Aerospace Corp., El Segundo, Calif.) *In* AFML Proc. of USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 971-1005 refs (For primary document see N79-25048 16-12)
Avail: NTIS HC A99/MF A01 CSCL 14B

Multiple internal reflection spectroscopy internal reflection elements (IRE's), thermal control surface witness plates, and quartz crystal microbalances (QCM's) were employed to measure contaminants condensible during an extended evacuation of the AEDC Mark 1 space chamber. An automatic particle counter was used to measure airborne particle density when the chamber was at atmospheric pressure. The nonvolatile residue wipe technique was employed to determine the general cleanliness of the chamber hardware. Temperature of the IRE's during chamber operation, was between 150 and 200 K. One QMC was temperature controlled to a temperature of 238 K; the other QCM operated at 135 K. After chamber repressurization, the IRE's were scanned in the 2 to 15 micron wavelength region. Resulting spectra indicated a coating of diffusion pump fluid (DC704) at a concentration level just above the limit of detectability. A.R.H.

N79-25084*# Aerojet Electrosystems Co., Azusa, Calif.
MEASUREMENTS OF THE KINETICS AND TRANSPORT PROPERTIES OF CONTAMINANTS RELEASED FROM POLYMERIC SOURCES IN SPACE AND THE EFFECTS ON COLLECTING SURFACES **c14**
E. A. Zeiner *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 1006-1088 refs (For primary document see N79-25048 16-12)
Avail: NTIS HC A99/MF A01 CSCL 14B

The source emission kinetics receptor reemission kinetics, and surface transport properties of the contaminants which are released by polymeric sources in space were measured. In addition to these mass transfer properties, measurements were made on the optical effects these contaminants had on receptors upon which they deposit. The primary instrument of the molecular kinetics test facility (Molekit), used for the mass transfer measurements, consists of an array of four quartz crystal microbalances (QCMs) positioned directly in front of the source. The contamination effects measurements were made in the surface materials effects facility which used an integrating sphere to measure changes in the spectral reflectance and transmittance on five typical receptors which were contaminated by the source materials and then irradiated with ultraviolet light. A.R.H.

N79-25085*# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).
THE INFLUENCE OF THE UV-INTENSITY ON IF-FILTER PROTECTED SECOND SURFACE MIRROR ALPHA SUB S STABILITIES, INCLUDING SURFACES WITH CONDUCTIVE TOP LAYERS **c14**
Otto K. Husmann, K. Kerner (Robert Bosch GmbH, Stuttgart), and J. Naegele (Deutsche Balzers GmbH, Geisenheim, West Germany) *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 1089-1111 refs (For primary document see N79-25048 16-12)
Avail: NTIS HC A99/MF A01 CSCL 14B

To retard the commonly experienced degradation of the solar absorption coefficient of SSM and OSR, several protective thin film coatings were applied to Teflon FEP SSM and Suprasil glass OSR. Both substrate materials were chosen because of their superior stability under solar radiation exposure, compared to other plastics and glasses. The performance of these protected substrates was evaluated in terms of their solar absorption changes under accelerated solar radiation test conditions, with 7.5 solar constants (SK), 3.5 SK, and 2 SK. Several sets of samples were exposed to UV radiation only, and to UV and proton radiation simultaneously. A few samples were coated with a thin layer of In2O3 to study their surface resistance during the course of simulated solar radiation exposure. Results indicate, that it is possible to maintain within the error limits a constant solar absorption coefficient of IF filter protected SSM and OSR over an exposure time of 3000 ESH. A.R.H.

N79-25086*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SILVER-TEFLON CONTAMINATION UV RADIATION STUDY **c74**
J. A. Muscari (Martin Marietta Aerospace) and S. Jacobs *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 1112-1127 refs (For primary document see N79-25048 16-12)
(Contract NAS9-15436)
Avail: NTIS HC A99/MF A01 CSCL 20F

A very low absorptance and a high emittance for heat rejection must be provided by the thermal control material covering the radiator surfaces on the Shuttle Orbiter payload bay doors. The effects of radiation upon silver-Teflon surfaces after contamination by the CVCM (collected volatile condensible mass) from RTV-560 and MIL-H-83282 hydraulic fluid were studied. The test procedure was depositing, irradiating, and measuring solar absorption changes (via reflectance measurements) in-situ. The stability of Ag/FEP to a vacuum environment and solar radiation, especially vacuum ultraviolet wavelengths, up to 370 EUVSH was verified. Although an undetermined geometrical factor produced solar absorptance values differing from the nominal 0.08, the sensitivity and repeatability of the instrumentation and analysis techniques were sufficient to determine a change of solar absorptance by 0.01. Current results for RTV-560 are presented and discussed. A.R.H.

N79-25087*# Aerospace Corp., El Segundo, Calif. Materials Sciences Lab.
THE CONTROL OF SPACECRAFT CONTAMINATION: WHERE ARE WE GOING **c18**
E. N. Borson *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 1129-1137 refs (For primary document see N79-25048 16-12)
Avail: NTIS HC A99/MF A01 CSCL 22B

Topics discussed by the panel include standards and requirements; cleaning; ground operations; contamination monitoring on the ground and in-flight; rocket motor plumes; modeling; and systems engineering. Methods used for contamination control in Europe and for verifying shuttle contamination levels are included. A.R.H.

N79-25088*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE DEEP SPACE NETWORK Progress Reports, Mar. 1979 - Apr. 1979
15 Jun. 1979 230 p refs
(NASA-CR-158704: PR-42-51) Avail: NTIS HC A11/MF A01 CSCL 14B

Progress in flight project support, tracking and data acquisition research and technology, network engineering, hardware and software implementation, and operations are reported. For individual titles, see N79-25089 through N79-25116.

N79-25089*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NETWORK FUNCTIONS AND FACILITIES **c14**
N. A. Renzetti *In its* The Deep Space Network 15 Jun. 1979 p 1-3 (For primary document see N79-25088 16-12)
Avail: NTIS HC A11/MF A01 CSCL 22D

The objectives, functions, and organization of the Deep Space Network are summarized; deep space station, ground communication, and network operations control capabilities are described. Author

N79-25090*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VOYAGER SUPPORT **c15**
J. E. Allen and H. E. Nance *In its* The Deep Space Network 15 Jun. 1979 p 4-13 (For primary document see N79-25088 16-12)
Avail: NTIS HC A11/MF A01 CSCL 22D

A continuation of the Deep Space Network report on tracking and data acquisition for Project Voyager is presented. The Jupiter encounter period for Voyager 1, from 1 January through March 1979 is covered. J.M.S.

N79-25091*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VIKING CONTINUATION MISSION SUPPORT **c15**
R. L. Gillette *In its* The Deep Space Network 15 Jun. 1979 p 14-18 (For primary document see N79-25088 16-12)
Avail: NTIS HC A11/MF A01 CSCL 22D

The Deep Space Network (DSN) support Viking spacecraft activities during the period 1 September 1978 through 31 March 1979 is reported. The DSN Viking command and tracking support is included. J.M.S.

N79-25092*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PIONEER VENUS 1978 MISSION SUPPORT **c14**
T. W. Howe *In its* The Deep Space Network 15 Jun. 1979 p 19-30 (For primary document see N79-25088 16-12)
Avail: NTIS HC A11/MF A01 CSCL 22D

The Deep Space Network support of the Pioneer Venus Mission is reported. The orbiter's Venus orbit insertion, multiprobe entry, and orbiter occultation experiment support are included. J.M.S.

N79-25093*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
STABILITY ANALYSIS OF THE MULTIMEGABIT TELEMETRY DEMODULATOR/DETECTOR DESIGN **c17**
J. K. Holmes *In its* The Deep Space Network 15 Jun. 1979 p 31-38 (For primary document see N79-25088 16-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

Stability of the multimegabit telemetry digital Costas loop is considered. It is shown that the present design is stable with

about 35.2 dB gain margin, and therefore is quite stable. The bandpass filter implementation of the data filters is covered.
J.M.S.

N79-25094*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PRE-A/D FILTER AND AGC REQUIREMENTS FOR MULTI-MEGABIT TELEMETRY DATA DETECTION **c17**
J. K. Holmes *In its* The Deep Space Network 15 Jun. 1979 p 39-46 refs (For primary document see N79-25088 16-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

A candidate pre-Analog to Digital filter bandwidth versus data rate design is presented for the multimegabit telemetry demodulator/detector. The design is based on considerations of Analog to Digital bias, quantization errors, and automatic gain control effects, as well as the deleterious effects of filtering. Two methods of gain control of the input level to the analog to Digital converter are considered. The first method uses a particular value of gain, according to which bandwidth is selected. The second method uses a second narrowband noncoherent Automatic Gain Controls (in the LPF bandwidth) to attempt to keep the Analog to Digital input level constant. This second method reduces the bit error rate degradation slightly but appears to be more difficult to implement.
J.M.S.

N79-25095*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
RECOVERING THE SPECTRUM OF A NARROW-BAND PROCESS FROM SYNCOPATED SAMPLES **c32**
P. H. Milenkovic *In its* The Deep Space Network 15 Jun. 1979 p 47-50 refs (For primary document see N79-25088 16-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

A nonuniform sampling strategy, phase quadrature sampling, in which a process of bandwith B is sampled at rate B in each of two channels where the two channels are pi/2 out of phase at frequency B is described. Phase quadrature sampling is a special case of sampling, where the phase between channels is fixed but arbitrary. A simple method for recovering the spectrum of the input process from syncopated samples is derived. The derivation indicates what values of phase between channels result in lossless sampling.
J.M.S.

N79-25096*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
INSTALLATION OF THE Mu2 RANGING SYSTEM IN AUSTRALIA **c14**
A. I. Zygielbaum *In its* The Deep Space Network 15 Jun. 1979 p 51-57 refs (For primary document see N79-25088 16-12)
Avail: NTIS HC A11/MF A01 CSCL 14B

The Mu2 ranging system has been installed at DSS 42/43 in Australia. It was used to support the 1979 Viking relativity experiment and is currently supporting Voyager navigation and the advanced systems program. These tasks as well as Mu2 software and hardware modifications prior to installation are described.
J.M.S.

N79-25097*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SOME EFFECTS OF QUANTIZATION ON A NOISELESS PHASE-LOCKED LOOP **c32**
C. A. Greenhall *In its* The Deep Space Network 15 Jun. 1979 p 58-66 refs (For primary document see N79-25088 16-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

If the VCO of a phase-locked receiver is to be replaced by a digitally programmed synthesizer, the phase error signal must be sampled and quantized. Effects of quantizing after the loop filter (frequency quantization) or before (phase error quantization) are investigated. Constant Doppler or Doppler rate noiseless inputs are assumed. The main result gives the phase jitter due to frequency quantization for a Doppler-rate input. By itself, however, frequency quantization is impractical because it makes the loop dynamic range too small.
J.M.S.

N79-25098*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A TRANSMISSION LINE PHASE STABILIZER **c33**
G. Lutes *In its* The Deep Space Network 15 Jun. 1979 p 67-71 ref (For primary document see N79-25088 16-12)
Avail: NTIS HC A11/MF A01 CSCL 09C

To meet the phase stability requirements of certain experiments performed with the Deep Space Network, transmission lines carrying reference signals must be stabilized to reduce changes in their electrical length due to mechanical movement or changes in ambient temperature. A transmission line phase stabilizer being developed at JPL to perform this function is described.
J.M.S.

N79-25099*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ANTENNA FEEDHORN SOFTWARE UPGRADE **c32**
P. D. Potter *In its* The Deep Space Network 15 Jun. 1979 p 75-84 refs (For primary document see N79-25088 16-12)
Avail: NTIS HC A11/MF A01 CSCL 20N

The HYBRIDHORN computer program was developed to serve as an item of general purpose antenna feedhorn design and analysis software. The formulation contains a small flare angle approximation which is subject to question for designs such as the S- and X-band feedhorn. Additionally, the original formulation did not allow azimuthal variation indexes other than unity. The HYBRIDHORN program was upgraded to correct both of these deficiencies. A large flare angle formulation was found. In the upgrade, all of the major program elements were converted to Univac 1108 compatible structured FORTRAN (SFTRAN) for ease of software maintenance. The small and large angle formulations are described and sample numerical results are presented.
J.M.S.

N79-25100*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
FEASIBILITY OF INERTIALESS CONSCAN UTILIZING MODIFIED DSN FEEDSYSTEMS **c32**
P. D. Potter *In its* The Deep Space Network 15 Jun. 1979 p 85-93 refs (For primary document see N79-25088 16-12)
Avail: NTIS HC A11/MF A01 CSCL 17I

The closed-loop conical-scan (conscan) technique has proven to be a useful method for pointing the DSN antennas more accurately than is possible by open-loop methods. As presently implemented, the antenna beam is scanned about the received signal direction by physical movement of the antenna. While straightforward, this approach has at least two disadvantages. Firstly, because of structural distortions, finite angle encoder resolution, and drive servo response, the actual antenna beam direction only approximates the commanded beam direction. Secondly, because of the large mass moved during scan, the rate of scan is severely restricted. If there are significant gain or signal level variations during a scan period, the conscan system interprets these variations as antenna pointing error. Both of these disadvantages would be alleviated in an inertialess conscan system in which the beam scanning was performed electronically. Recently, standard JPL antenna feedhorn software was upgraded to calculate, among other things, asymmetric corrugated horn radiation patterns of the type that would be needed for electronic beam scan. The required horn excitation is discussed and the results were described.
J.M.S.

N79-25101*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COSTAS LOOP DEMODULATION OF SUPPRESSED CARRIER BPSK SIGNALS IN THE DSN ENVIRONMENT: EXPERIMENTAL RESULTS OBTAINED AT TDL **c32**
R. Reasoner *In its* The Deep Space Network 15 Jun. 1979 p 94-104 refs (For primary document see N79-25088 16-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

Suppressed carrier binary phase-shift keyed (BPSK) signalling is currently being considered as a design alternative for future DSN telemetry in the multimegabit range. Carrier tracking of such signals is usually achieved by a Costas loop, as opposed to the ordinary phase lock loop. A Costas loop capable of demodulating BPSK signals with data rates up to 1 Msps was designed and constructed and its Doppler tracking performance with respect to a Block 3 receiver was tested at the Telecommunications Development Laboratory (TDL). The compatibility of suppressed carrier signalling with the current radiometric system, specifically Doppler tracking and ranging, was investigated. The experimental results obtained to-date with respect to Doppler tracking are presented.
J.M.S.

N79-25102*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
EFFECTS OF ASYMMETRIC PASSBAND FILTERING ON THE PHASE OF THE COSTAS LOOP'S RECONSTRUCTED CARRIER **c17**

K. T. Woo *In its* The Deep Space Network 15 Jun. 1979 p 105-112 refs (For primary document see N79-25088 16-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

The reconstructed carrier of a telemetry return signal is used in deriving the Doppler and range information in the radiometric systems. When suppressed carrier BPSK signalling with Costas loop demodulation is used, there are concerns on the amount of shift in the reconstructed carrier phase, when the received signal suffers asymmetric bandpass filtering through the various stages of the receiver. It is concluded that the phase shifts due to asymmetric bandpass filtering on the Costas loop's reconstructed carrier can be slightly worse than those suffered by the residual carrier loop's reconstructed carrier. However, they are well within the error budgets of the radiometric system. J.M.S.

N79-25103*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DESIGN OF A COSTAS LOOP TO OPERATE WITH THE BLOCK 3 RECEIVER AND ITS PREDICTED PERFORMANCE **c17**
G. Stevens and K. T. Woo *In its* The Deep Space Network 15 Jun. 1979 p 113-123 refs (For primary document see N79-25088 16-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

The system design, hardware construction, and predicted performance of a Costas loop is presented. Its expected performance regarding steady state phase error under assumed Doppler conditions, rms phase jitter, and their respective sensitivities with respect to variations in signal to noise ratios are discussed. M.M.M.

N79-25104*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE CONSTANTIN-RAO CONSTRUCTION FOR BINARY ASYMMETRIC ERROR-CORRECTING CODES **c63**
R. J. McEliece and E. R. Rodemich *In its* The Deep Space Network 15 Jun. 1979 p 124-129 refs (For primary document see N79-25088 16-12)
Avail: NTIS HC A11/MF A01 CSCL 09B

An analysis of the size of a class of binary codes capable of correcting a single asymmetric error is presented. M.M.M.

N79-25105*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CARRIER TRACKING LOOP PERFORMANCE IN THE PRESENCE OF STRONG CW INTERFERENCE **c32**
B. K. Levitt *In its* The Deep Space Network 17 Jun. 1979 p 130-137 refs (For primary document see N79-25088 16-12)
Avail: NTIS HC A11/MF A01 CSCL 20N

Research on the behavior of the carrier tracking loop exposed to a continuous wave irradiation along with Bruno's closed form of approximation for the loop phase error are described. M.M.M.

N79-25106*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSS 13 ANTENNA MONITOR SYSTEM **c32**
B. Siev and D. Bayergo *In its* The Deep Space Network 15 Jun. 1979 p 138-140 (For primary document see N79-25088 16-12)
Avail: NTIS HC A11/MF A01 CSCL 09C

The development of a monitor system for the DSS 13 antenna is presented. The system checks for accumulator pressures, differential pressures, wind velocity, power supplies, fluid temperatures, and fluid levels. It was concluded that the system performed properly in high winds and correctly reported all malfunctions. M.M.M.

N79-25107*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CODES FOR A PRIORITY QUEUE ON A PARALLEL DATA BUS **c63**
D. E. Wallis and H. Taylor *In its* The Deep Space Network 15 Jun. 1979 p 141-143 (For primary document see N79-25088 16-12)
Avail: NTIS HC A11/MF A01 CSCL 09B

Some codes for arbitration of priorities among subsystem computers or peripheral device controllers connected to a parallel data bus are described. At arbitration time, several subsystems present wire-OR, parallel code words to the bus, and the central computer can identify the subsystem of highest priority and determine which of two or more transmission services the subsystem requires. A mathematical discussion of the optimality of the codes with regard to the number of subsystems that may participate in the scheme for a given number of wires is presented along with the number of services that each subsystem may request. M.M.M.

N79-25108*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MATHEMATICAL MODEL FOR PREVENTIVE MAINTENANCE SCHEDULING **c38**
G. Lorden and D. S. Remer *In its* The Deep Space Network 15 Jun. 1979 p 144-149 refs (For primary document see N79-25088 16-12)
Avail: NTIS HC A11/MF A01 CSCL 14D

A model is formulated to describe the effect of the time interval chosen for preventive maintenance upon the frequency of failure and frequency of total maintenance. Trade-offs between these two frequencies are determined by computation of an optimal interval in the case where the failure distribution is known. For unknown distributions, an adaptive statistical technique is developed that converges to an optimal preventive maintenance interval. A numerical illustration is given. M.M.M.

N79-25109*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PRELIMINARY MAINTENANCE EXPERIENCE FOR DSS 13 UNATTENDED OPERATIONS DEMONSTRATION **c60**
D. S. Remer and G. Lorden (California Institute of Technology) *In its* the Deep Space Network 15 Jun. 1979 p 150-161 refs (For primary document see N79-25088 16-12)
Avail: NTIS HC A11/MF A01 CSCL 09B

The maintenance data base collected for 15 weeks of recent unattended and automated operation of DSS 13 is summarized. During this period, DSS 13 was receiving spacecraft telemetry while being controlled remotely from JPL in Pasadena. Corrective and preventive maintenance manhours are reported by subsystem for DSS 13 including the equipment added for the automation demonstration. The corrective and preventive maintenance weekly manhours at DSS 13 averaged 22 and 40, respectively. The antenna hydraulic and electronic systems accounted for about half of the preventive and corrective maintenance manhours for a comparable attended DSN station, DSS 11. M.M.M.

N79-25110*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
QUICK-LOOK DECODING SCHEMES FOR DSN CONVOLUTIONAL CODES **c63**
C. A. Greenhall and R. L. Miller *In its* The Deep Space Network 15 Jun. 1979 p 162-166 ref (For primary document see N79-25088 16-12)
Avail: NTIS HC A11/MF A01 CSCL 09B

Decoding schemes are proposed for the tracking systems of the galileo project. Quick look decoding schemes requiring only shift registers are given for the DSN (7, 1/2) and (7, 1/3) convolutional codes. These schemes are used when the communication channel is error free. The schemes decode the data, symbol errors, and the lack of node syncronization. M.M.M.

N79-25111*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN ENERGY DATA BASE PRELIMINARY DESIGN **c44**
E. R. Cole, L. O. Herrera, and D. M. Lascu *In its* The Deep Space Network 15 Jun. 1979 p 167-181 refs (For primary document see N79-25088 16-12)
Avail: NTIS HC A11/MF A01 CSCL 10B

The design and implementation of a computerized data base created to support the DSN Energy Conservation Project with data relating to energy use at Goldstone Deep Space Communications Complex are described. The results of development work to date, are presented along with work currently in progress or in the planning stage. M.M.M.

N79-25112*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MICROWAVE TIME DELAYS IN THE DSN 34- AND 64-METER ANTENNAS **c32**
R. Hartop *In its* The Deep Space Network 15 Jun. 1979 p 183-185 (For primary document see N79-25088 16-12)
Avail: NTIS HC A11/MF A01 CSCL 20N

The results and methods used to derive data for the recent changes to the DSN 34- and 64-m stations at both S- and X-band frequencies are presented. M.M.M.

N79-25113*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ASSESSMENT OF 20 kW S-BAND TRANSMITTER **c32**

R. Dickinson and H. Hansen *In its* The Deep Space Network 15 Jun. 1979 p 186-192 refs (For primary document see N79-25088 16-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

The performance history of the 20-kW S-band transmitter, installed at three 64-meter antennas and six 26-meter antennas in the DSN, is reviewed. A number of failures and discrepancy reports are characteristic of the wearout phase of a failure curve. The type of failures are reviewed and four options toward reducing the number and cost of failures are reviewed. These are: existing (no change), refurbish, redesign and replacement. The options are compared on a ten year life cycle cost basis using FY77 expenditures for existing equipment as a base. It was concluded that benefits, in terms of reduction of outrage time, increase with an increase of expenditure toward improvement. M.M.M.

N79-25114*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A CIRCUIT MODEL FOR ELECTROMAGNETIC PROPERTIES OF WAVEGUIDE ARCS **c32**
J. C. Yen *In its* The Deep Space Network 15 Jun. 1979 p 193-195 refs (For primary document see N79-25088 16-12)
Avail: NTIS HC A11/MF A01 CSCL 09C

A dielectric model of waveguide arcs is presented to relate measurable electromagnetic quantities to the physical parameters characterizing the breakdown process. M.M.M.

N79-25115*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
WAVEGUIDE ARC STUDY **c33**
H. C. Yen *In its* The Deep Space Network 15 Jun. 1979 p 196-203 ref (For primary document see N79-25088 16-12)
Avail: NTIS HC A11/MF A01 CSCL 09C

Research on waveguide arcs is presented as well as an evaluation on an arc detector. Ways of improving the radio frequency arc generation include methods of generating RF arcs inside the resonator. Dc nitrogen arcs were used to study a spectroradiometer. The spectral strucutres obtained provide a general sketch of spectral distribution and their relative magnitude. The upgrading of a transmitter test light and the simulation of an LED array are reported. M.M.M.

N79-25116*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
RADIO FREQUENCY INTERFERENCE EFFECTS OF CONTINUOUS WAVE SIGNALS ON TELEMETRY DATA, PART 2 **c17**
P. W. Low *In its* The Deep Space Network 15 Jun. 1979 p 204-215 ref (For primary document see N79-25088 16-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

The results of radio frequency interference tests and the derived telemetry bit SNR degradation model, which includes the telemetry data rate and the telemetry data power as independent variables for characterizing the continuous wave interference effects on telemetry data, are presented. The telemetry bit SNR degradation model was implemented in the second version of the Deep Space Interference Prediction software. M.M.M.

N79-25117# Committee on Science and Technology (U. S. House).
NASA SPACE AND TERRESTRIAL APPLICATIONS, USER DEVELOPMENT ACTIVITIES
Washington GPO 1978 498 p refs Hearings before the Subcomm. on Space Sci. and Applications of the Comm. on Sci. and Technol., 95th Congr., 2d Sess., 27-29 Jun. 1978
(GPO-32-438) Avail: Subcomm. on Space Sci. and Applications

The remote sensing technology of NASA's earth monitoring programs is discussed as well as its transfer of activities to the commercial market place. M.M.M.

N79-25118# British Aerospace Dynamics (Space), Stevenage (England).
THE AUTONOMOUS STATIONKEEPING SYSTEM (ASKS) Final Report
B. Vendy, comp. and D. Plummer, comp Paris ESA Jul. 1978 134 p refs
(Contrac. ESTEC-3223/77-NL-AK(SC))
(BAE-TP-7696; ESA-CR(P)-1143) Avail: NTIS HC A07/MF A01

How a three-axis controlled geosynchronous spacecraft can maintain itself close to its chosen station without assistance from the ground was studied. Several methods were discussed and a selection was made. The preferred concept uses available hardware and can also be added onto any geosynchronous spacecraft without a major impact on its configuration or on other subsystems. The equations governing the motion of the spacecraft, including perturbations and the effect of maneuvers, are shown to be of simple form in terms of a set of six mean elements. The system is shown to be observable and controllable and is applicable to the use of conventional thrusters or electric propulsion. The requirements placed by the system on a microprocessor or a share of an existing onboard computer were derived and the basic algorithm was chosen to be a least squares one rather than a Kalman filter, mainly for reasons or robustness. Simulation of the system produces answers in agreement with theoretical expectations and shows that stationkeeping accuracies of the order + or - 0.1 deg are achievable in latitude and longitude. Software and hardware interfaces are discussed and future developments foreseen. Author (ESA)

N79-25119# New Mexico Univ., Albuquerque. Technology Application Center.
THE SKYLAB PROGRAM VOLUME 2. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1975 - Dec. 1978
Gerald F. Zollars Apr. 1979 76 p Sponsored by NTIS
(NTIS/PS-79/0336/2) Avail: NTIS HC $28.00/MF $28.00 CSCL 22A

The cited articles concern observations from the Apollo telescope mount, aplications of remote sensing data from skylab, research concerned with solar X-rays and the solar corona, various aspects of aerospace medicine, and other experiments performed aboard skylab. GRA

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N79-25120# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ON DETERMINING THE PLANE OF AN ARTIFICIAL SATELLITE'S ORBIT
Laurence G. Taff Jan. 1979 24 p refs
(Contract F19628-78-C-0002)
(AD-A066248; ETS-42; ESD-TR-79-1) Avail: NTIS HC A02/MF A01 CSCL 22/3

The problem of rapidly and accurately determining the orbital plane of an artificial earth satellite from a short series (< or = to 10 to the Mth power) of observations is posed and solved. The observations can be either angles only data or angles and angular rates. The accuracy is generally 5 deg. In addition, another look is given to the angular velocity distance estimation technique. Author (GRA)

N79-25121# Federal Electric Corp., Vandenberg AFB, Calif. Performance Analysis Dept.
TRAJECTORY RECONSTRUCTION AND ANALYSIS METHODOLOGY. MATHEMATICS AND GUIDELINES FOR PROGRAM IMPLEMENTATION Final Report
R. A. Brooks 29 Nov. 1978 193 p refs
(Contract F04703-77-C-0111)
(AD-A066375; PA100-78-58; SAMTEC-TR-79-1) Avail: NTIS HC A09/MF A01 CSCL 16/2

Optimal estimation techniques are applied to certain fundamental problems associated with ballistic missile testing. These problems include multiple vehicle trajectory reconstruction and performance analysis of metric, telemetry and vehicle subsystems. The mathematical background and guidelines for program implementation are provided for a recursive filtering and smoothing realization of the optimum linear estimator. Considerable emphasis is placed on efficient computation with minimal introduction of processing error. System considerations are applied to the aggregate tracking and estimation functions, and the optimum interface between tracking (data collection) and estimation (data processing) is identified. Author (GRA)

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N79-25122*# Howard Univ., Washington, D. C. School of Engineering.
THE DYNAMICS AND CONTROL OF LARGE FLEXIBLE SPACE STRUCTURES, 2. PART A: SHAPE AND ORIENTATION CONTROL USING POINT ACTUATORS Final Report
Peter M. Bainum and A. S. S. R. Reddy Jun. 1979 78 p refs
(Grant NsG-1414)
(NASA-CR-158684) Avail: NTIS HC A05/MF A01 CSCL 22B

The equations of planar motion for a flexible beam in orbit which includes the effects of gravity gradient torques and control torques from point actuators located along the beam was developed. Two classes of theorems are applied to the linearized form of these equations to establish necessary conditions for controlability for preselected actuator configurations. The feedback gains are selected: (1) based on the decoupling of the original coordinates and to obtain proper damping, and (2) by applying the linear regulator problem to the individual model coordinates separately. The linear control laws obtained using both techniques were evaluated by numerical integration of the nonlinear system equations. Numerical examples considering pitch and various number of modes with different combination of actuator numbers and locations are presented. The independent model control concept used earlier with a discretized model of the thin beam in orbit was reviewed for the case where the number of actuators is less than the number of modes. Results indicate that although the system is controllable it is not stable about the nominal (local vertical) orientation when the control is based on modal decoupling. An alternate control law not based on modal decoupling ensures stability of all the modes. S.E.S.

N79-25083*# ARO, Inc., Arnold Air Force Station, Tenn.
SPACECRAFT TEST CHAMBER CONTAMINATION STUDY, AEDC MARK 1 FACILITY
J. G. Pipes, D. F. Frazine, R. P. Young, E. N. Borson (Aerospace Corp., El Segundo, Calif.), and L. H. Rachal (Aerospace Corp., El Segundo, Calif.) *In* AFML Proc. of USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 971-1005 refs (For primary document see N79-25048 16-12)
Avail: NTIS HC A99/MF A01 CSCL 14B

N79-25084*# Aerojet Electrosystems Co., Azusa, Calif.
MEASUREMENTS OF THE KINETICS AND TRANSPORT PROPERTIES OF CONTAMINANTS RELEASED FROM POLYMERIC SOURCES IN SPACE AND THE EFFECTS ON COLLECTING SURFACES
E. A. Zeiner *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 1006-1088 refs (For primary document see N79-25048 16-12)
Avail: NTIS HC A99/MF A01 CSCL 14B

N79-25085*# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).
THE INFLUENCE OF THE UV-INTENSITY ON IF-FILTER PROTECTED SECOND SURFACE MIRROR ALPHA SUB S STABILITIES, INCLUDING SURFACES WITH CONDUCTIVE TOP LAYERS
Otto K. Husmann, K. Kerner (Robert Bosch GmbH, Stuttgart), and J. Naegele (Deutsche Balzers GmbH, Geisenheim, West Germany) *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 1089-1111 refs (For primary document see N79-25048 16-12)
Avail: NTIS HC A99/MF A01 CSCL 14B

N79-25089*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NETWORK FUNCTIONS AND FACILITIES
N. A. Renzetti *In its* The Deep Space Network 15 Jun. 1979 p 1-3 (For primary document see N79-25088 16-12)
Avail: NTIS HC A11/MF A01 CSCL 22D

N79-25092*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PIONEER VENUS 1978 MISSION SUPPORT
T. W. Howe *In its* The Deep Space Network 15 Jun. 1979 p 19-30 (For primary document see N79-25088 16-12)
Avail: NTIS HC A11/MF A01 CSCL 22D

N79-25096*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
INSTALLATION OF THE Mu2 RANGING SYSTEM IN AUSTRALIA
A. I. Zygielbaum *In its* The Deep Space Network 15 Jun. 1979 p 51-57 refs (For primary document see N79-25088 16-12)
Avail: NTIS HC A11/MF A01 CSCL 14B

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N79-25123# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
SATELLITE NETWORKS FOR MULTIPLE COVERAGE Final Report
Melchor Louis Suarez 11 Jun. 1977 70 p refs
(Contract N00030-77-C-0070)
(AD-A062849; T-647) Avail: NTIS HC A04/MF A01 CSCL 22/3

A computer program is described which helps to find the optimal configuration. In particular, performance of a twenty-fou satellite constellation is analyzed for triple coverage and the result: given. Constellations where the number of orbital planes equa the number of satellites (N=P) and constellations where N doe: not equal P are both analyzed. Circular orbits are assumed. Th computer program is relatively short using a sampling grid ove a quarter of the globe. The results are approximately correc sufficient for a feasibility study. Author (GRA

N79-25124# Applied Physics Lab., Johns Hopkins Univ., Laurel Md.
ARTIFICIAL EARTH SATELLITE DESIGNED AND FABRICATED BY THE JOHNS HOPKINS UNIVERSITY APPLIED PHYSICS LABORATORY, REVISED Status Report, 1959 - 1978
Jul. 1978 242 p refs Revised
(Contract N00024-78-C-5384)
(AD-A066299; APL/JHU/SDO-1600-Rev) Avail: NTIS HC A11/MF A01 CSCL 22/2

Satellites designed and fabricated by the Applied Physics Laboratory of The Johns Hopkins University since the inception of the space program at APL in 1957 are described. The descriptions, including artist's concepts and other illustrations, are arranged in chronological order according to primary mission category. Satellite categories include navigation satellites (Transit, TRIAD, TIP, TRANSAT, etc.), geodetic research satellites (ANNA, GEOS, LIDOS, etc.), orbital environment and dynamics research satellites (TRAAC, 5E-series, DODGE), ionospheric research satellites (Beacon and Direct Measurement Explorers, P76-5), and astronomical exploration satellites (Small Astronomy Satellites). Appendixes include a functional description of the Navy Navigation Satellite System and several bibliographies. This report is updated from time to time with the issuance of new and revised material, and is one of a series that includes APL/JHU SDO-3100, 'Navy Navigation Satellite System User Equipment Handbook' and APL/JHU SDO-4100, 'Instrumentation Developed by APL/JHU for Non-APL Spacecraft.' Author (GRA)

N79-25125# Raytheon Co., Sudbury, Mass. Equipment Div.
MILSATCOM SPACECRAFT PROCESSING STUDY. TECHNOLOGICAL LIMITATIONS ON SATELLITE PROCESSOR APPLICATIONS Final Report, May - Oct. 1978
A. A. Castro, J. Eachus, F. Howes, E. Lewis, and J. Stiffler

15 Nov. 1978 101 p refs
(Contract DCA100-78-C-0012)
(AD-A066455; AD-E100167; ER78-4370) Avail: NTIS HC A06/MF A01 CSCL 22/2

This Study Report describes the technological limitations for performing on board signal processing in MILSATCOM satellites. The operational use of this hardware is for the post 1990 time frame and for the UHF, SHF and EHF bands. The study investigates the limitations imposed by frequency of use, feasible bandwidths, processing gains, chip rates, baseband processing rates and weight/volume/mission reliability. Author (GRA)

N79-25126# New Mexico Univ., Albuquerque. Technology Application Center.
COMMUNICATION SATELLITE TECHNOLOGY, VOLUME 3. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1978
Gerald F. Zollars Apr. 1979 69 p Sponsored by NTIS
(NTIS/PS-79/0334/7) Avail: NTIS HC $28.00/MF $28.00 CSCL 17B

Satellite networks, satellite design, microwave transmission, ground stations, antennas, and time division multiple access are discussed. Contains 266 abstracts. GRA

N79-25080*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PARTICULATE CONTAMINATION CONTROL FOR THE VIKING AND VOYAGER UNMANNED PLANETARY SPACECRAFT
Alan R. Hoffman and Robert C. Koukol *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 899-926 ref (For primary document see N79-25048 16-12)
(Contract NAS7-100)
Avail: NTIS HC A99/MF A01 CSCL 22B

N79-25090*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VOYAGER SUPPORT
J. E. Allen and H. E. Nance *In its* The Deep Space Network 15 Jun. 1979 p 4-13 (For primary document see N79-25088 16-12)
Avail: NTIS HC A11/MF A01 CSCL 22D

N79-25091*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VIKING CONTINUATION MISSION SUPPORT
R. L. Gillette *In its* The Deep Space Network 15 Jun. 1979 p 14-18 (For primary document see N79-25088 16-12)
Avail: NTIS HC A11/MF A01 CSCL 22D

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

N79-25127*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
IMPLEMENTATION PROCEDURE FOR STS PAYLOADS, SYSTEM SAFETY REQUIREMENTS
May 1979 22 p
(NASA-TM-80466; JSC-13830) Avail: NTIS HC A02/MF A01 CSCL 22B

Guidelines and instructions for the implementation of the SP&R system safety requirements applicable to STS payloads are provided. The initial contact meeting with the payload organization and the subsequent safety reviews necessary to comply with the system safety requirements of the SP&R document are described. Waiver instructions are included for the cases in which a safety requirement cannot be met. J.A.M.

N79-25128*# LinCom Corp., Pasadena, Calif.
SHUTTLE/TDRSS MODELLING AND LINK SIMULATION STUDY Final Report
W. R. Braun, T. M. McKenzie, L. Biederman, and W. C. Lindsey 20 Apr. 1979 169 p refs
(Contract NAS9-14846)
(NASA-CR-160168; TR-7904-0476a) Avail: NTIS HC A08/MF A01 CSCL 22B

A Shuttle/TDRSS S-band and Ku-band link simulation package called LinCsim was developed for the evaluation of link performance for specific Shuttle signal designs. The link models were described in detail and the transmitter distortion parameters or user constraints were carefully defined. The overall link degradation (excluding hardware degradations) relative to an ideal BPSK channel were given for various sets of user constraint values. The performance sensitivity to each individual user constraint was then illustrated. The effect of excessive Spacelab clock jitter on the return link BER performance was also investigated as was the problem of subcarrier recovery for the K-band Shuttle return link signal. R.E.S.

N79-25129*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LOW-THRUST CHEMICAL ORBIT TRANSFER PROPULSION
J. J. Pelouch, Jr. 1979 22 p refs Presented at the 15th Joint Propulsion Conf., Las Vegas, Nev., 18-20 Jun. 1979; sponsored by AIAA, Soc. of Automotive Engr., and ASME
(NASA-TM-79190; E-059) Avail: NTIS HC A02/MF A01 CSCL 22B

The need for large structures in high orbit is reported in terms of the many mission opportunities which require such structures. Mission and transportation options for large structures are presented, and it is shown that low-thrust propulsion is an enabling requirement for some missions and greatly enhancing to many others. Electric and low-thrust chemical propulsion are compared, and the need for an requirements of low-thrust chemical propulsion are discussed in terms of the interactions that are perceived to exist between the propulsion system and the large structure. S.E.S.

N79-25054*# Martin Marietta Aerospace, Denver, Colo.
SPACELAB INDUCED ENVIRONMENT TECHNICAL OVERVIEW
L. E. Bareiss *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 152-175 refs (For primary document see N79-25048 16-12)
(Contract NAS8-31574)
Avail: NTIS HC A99/MF A01 CSCL 22B

N79-25058*# Old Dominion Univ., Norfolk, Va.
SHUTTLE FLOW FIELD ANALYSIS USING THE DIRECT SIMULATION MONTE CARLO TECHNIQUE
J. E. Hueser and F. J. Brock *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 250-273 refs (For primary document see N79-25048 16-12)
(Grant NsG-1271)
Avail: NTIS HC A99/MF A01 CSCL 22B

N79-25062*# Marquardt Corp., Van Nuys, Calif.
SPACE SHUTTLE PLUME CONTAMINATION
R. Carl Stechman *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 401-411 refs (For primary document see N79-25048 16-12)
Avail: NTIS HC A99/MF A01 CSCL 22B

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications.*

N79-25093*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
STABILITY ANALYSIS OF THE MULTIMEGABIT TELEMETRY DEMODULATOR/DETECTOR DESIGN
J. K. Holmes *In its* The Deep Space Network 15 Jun. 1979 p 31-38 (For primary document see N79-25088 16-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

N79-25094*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PRE-A/D FILTER AND AGC REQUIREMENTS FOR MULTI-MEGABIT TELEMETRY DATA DETECTION
J. K. Holmes *In its* The Deep Space Network 15 Jun. 1979 p 39-46 refs (For primary document see N79-25088 16-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

N79-25102*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
EFFECTS OF ASYMMETRIC PASSBAND FILTERING ON THE PHASE OF THE COSTAS LOOP'S RECONSTRUCTED CARRIER
K. T. Woo *In its* The Deep Space Network 15 Jun. 1979 p 105-112 refs (For primary document see N79-25088 16-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

N79-25103*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DESIGN OF A COSTAS LOOP TO OPERATE WITH THE BLOCK 3 RECEIVER AND ITS PREDICTED PERFORMANCE
G. Stevens and K. T. Woo *In its* The Deep Space Network 15 Jun. 1979 p 113-123 refs (For primary document see N79-25088 16-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

N79-25116*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
RADIO FREQUENCY INTERFERENCE EFFECTS OF CONTINUOUS WAVE SIGNALS ON TELEMETRY DATA, PART 2
P. W. Low *In its* The Deep Space Network 15 Jun. 1979 p 204-215 ref (For primary document see N79-25088 16-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N79-25052*# Martin Marietta Aerospace, Denver, Colo.
APPLICABILITY OF THERMOGRAVIMETRIC ANALYSIS TO SPACE CONTAMINATION
J. A. Muscari, R. O. Rantanen, and N. J. Pugel (Denver Univ.) *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 107-117 refs (For primary document see N79-25048 16-12)
(Contract F33615-76-C-5212)
Avail: NTIS HC A99/MF A01 CSCL 22B

N79-25053*# European Space Technology Center, Noordwijk (Netherlands). Product Assurance Div.
OUTGASSING MEASUREMENTS ON MATERIALS IN VACUUM USING A VACUUM BALANCE AND QUARTZ CRYSTAL BALANCES
A. Zwaal *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 118-150 refs (For primary document see N79-25048 16-12)
Avail: NTIS HC A99/MF A01 CSCL 22B

N79-25055*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INFRARED RADIATION FROM THE SPACE SHUTTLE CONTAMINANT ENVIRONMENT
J. P. Simpson and F. C. Witteborn *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 176-207 refs (For primary document see N79-25048 16-12)
(Contract NAS2-9636)
Avail: NTIS HC A99/MF A01 CSCL 22B

N79-25056*# Aerojet Electrosystems Co., Azusa, Calif.
SPACECRAFT CONTAMINATION MODEL DEVELOPMENT
J. M. Millard and C. R. Maag *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 208-229 refs (For primary document see N79-25048 16-12)
(Contract F04701-76-C-0220)
Avail: NTIS HC A99/MF A01 CSCL 22B

N79-25057*# Aerojet Electrosystems Co., Azusa, Calif.
AN IMPROVED ANALYTIC TECHNIQUE TO PREDICT SPACE SYSTEM CONTAMINATION
R. R. Hale *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 230-249 refs (For primary document see N79-25048 16-12)
(Contract F04701-77-C-0010)
Avail: NTIS HC A99/MF A01 CSCL 22B

N79-25066*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SHUTTLE INDUCED ENVIRONMENT CONTAMINATION MONITOR
Edgar R. Miller *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 534-566 refs (For primary document see N79-25048 16-12)
Avail: NTIS HC A99/MF A01 CSCL 14B

N79-25077*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
EFFECTIVENESS OF THE SHUTTLE ORBITER PAYLOAD BAY LINER AS A BARRIER TO MOLECULAR CONTAMINATION FROM HYDRAULIC FLUIDS
R. G. Richmond and R. M. Kelso *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 846-862 refs (For primary document see N79-25048 16-12)
Avail: NTIS HC A99/MF A01 CSCL 22B

N79-25087*# Aerospace Corp., El Segundo, Calif. Materials Sciences Lab.
THE CONTROL OF SPACECRAFT CONTAMINATION: WHERE ARE WE GOING
E. N. Borson *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 1129-1137 refs (For primary document see N79-25048 16-12)
Avail: NTIS HC A99/MF A01 CSCL 22B

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

No abstracts in this category.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N79-25130 Colorado State Univ., Fort Collins.
PREDICTION OF PLASMA PROPERTIES IN MERCURY ION THRUSTERS Ph.D. Thesis
Glen Reed Longhurst 1978 120 p
Avail: Univ. Microfilms Order No. 7913823

A theoretical model is developed which obtains to first order the plasma properties in the discharge chamber of a mercury ion thruster from basic thruster design data and controllable operating parameters. The operation and design of ion thrusters is discussed, and the important processes which influence the plasma properties are described in terms of the design and control parameters. The agreement between calculated and measured

values of plasma properties is good in light of the many simplifications introduced to make the problem tractable. By varying the input power to the computer model, it is possible to generate thruster performance curves from design and control data alone. These performance curves have good similarity to actually measured performance curves, although the calculated curves show somewhat poorer performance due to a consistent underestimation of beam current. Dissert. Abstr.

N79-25131*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE 30-CENTIMETER ION THRUST SUBSYSTEM DESIGN MANUAL
Jun. 1979 579 p refs
(NASA-TM-79191; E-060) Avail: NTIS HC A25/MF A01 CSCL 09C

The principal characteristics of the 30-centimeter ion propulsion thrust subsystem technology that was developed to satisfy the propulsion needs of future planetary and early orbital missions are described. Functional requirements and descriptions, interface and performance requirements, and physical characteristics of the hardware are described at the thrust subsystem, BIMOD engine system, and component level. G.Y.

N79-25132*# Illinois Inst. of Tech., Chicago.
REVIEW OF COAXIAL FLOW GAS CORE NUCLEAR ROCKET FLUID MECHANICS Final Report
Herbert Weinstein Jul. 1976 84 p refs
(Grant NsG-7039)
(NASA-CR-158549) Avail: NTIS HC A05/MF A01 CSCL 21F

Almost all of the fluid mechanics research associated with the coaxial flow gas core reactor ended abruptly with the interruption of NASA's space nuclear program because of policy and budgetary considerations in 1973. An overview of program accomplishments is presented through a review of the experiments conducted and the analyses performed. Areas are indicated where additional research is required for a fuller understanding of cavity flow and of the factors which influence cold and hot flow containment. A bibliography is included with graphic material. A.R.H.

N79-25133# Committee on Commerce, Science, and Transportation (U. S. Senate).
SPACE SHUTTLE MAIN ENGINE DEVELOPMENT PROGRAM
Washington GPO 1978 85 p refs Hearing before the Subcomm. on Sci., Technol., and Space of the Comm. on Commerce, Sci., and Transportation, 95th Congr., 2d Sess.; 31 Mar. 1978
(GPO-28-027) Avail: Subcomm. on Sci., Technol., and Space

The development of the main engines for the nation's space shuttle, the principal transportation system for both civilian and military operations in space, was reviewed before a Congressional hearing. Since the engine is a technologically new type of fuel system, safety, reliability, and feasibility were the main aspects of interest. Scheduling was also discussed. R.E.S.

N79-25134# Texas Univ. at Austin. Dept. of Aerospace Engineering and Engineering Mechanics.
STUDY OF THE EXHAUST PLUME FOR HIGHLY UNDEREXPANDED SUPERSONIC NOZZLES EXHAUSTING INTO QUIESCENT AIR Final Report, Jul. 1977 - Sep. 1978
Samuel J. Sutter, Jr., John J. Bertin, Edward J. Zihlman, Jr., and David P. Dannemiller Jan. 1979 76 p refs
(Contract DAAK40-77-C-0130)
(AD-A066595; Rept-79001) Avail: NTIS HC A05/MF A01 CSCL 21/2

To optimize the performance of a tube launched rocket system, the mechanism which generates the flow in the annular gap must be accurately modeled during the system design phase. The present program defines the exhaust plume which results when an underexpanded, supersonic steam exhausts into quiescent air. The free plumes of three different nozzle geometrical configurations are compared with theoretical method-of-characteristic solutions. The results are a foundation upon which the tube-launched rocket designer may base decisions regarding the fabrication of hardware which will successfully control the flow in the annular gap. The report also discusses the current attributes and shortcomings of the University's numerical codes and provides a range of empirical data with which to evaluate future developments in the codes and to make assessments of continued rocket system advancements. Author (GRA)

N79-25135# Texas Univ. at Austin. Dept. of Aerospace Engineering and Engineering Mechanics.
THE EFFECT OF A COMPLETE SPIN TURBINE ON THE EXHAUST FLOW-FIELD FOR A TUBE-LAUNCHED ROCKET Final Report, Jul. 1977 - Sep. 1978
Samuel J. Sutter, Jr. Jan. 1979 34 p refs
(Contract DAAK40-77-C-0131)
(AD-A066594; Rept-79002) Avail: NTIS HC A03/MF A01

Unbalanced forces on tube launched rockets during launch caused by exhaust fluid flow in the launcher-rocket annular gap is a problem confronting tube-launched rocket system designers. One alternative considered to alleviate the adverse effects is to rotate the rocket about its center of gravity during the launch phase to average out small deviations in the flight path. The spin turbine is a possible alternative with which to increase the rocket's angular momentum. Previous work considered a single vane's effect on the exhaust flow, a complete spin turbine effect on the exhaust flow, and a rocket nozzle equipped with a complete spin turbine exhausting into a cylindrical launch tube. The current program demonstrates a significant difference in the flow around an isolated single vane from that around a single vane of a complete spin turbine. Three vane heights are considered. Author (GRA)

N79-25136# Naval Postgraduate School, Monterey, Calif.
AN EXPERIMENTAL INVESTIGATION OF THE DUAL CHAMBER ROCKET
J. F. McFillin, Jr. and D. W. Netzer Jan. 1979 47 p refs
(AD-A066494; NPS67-79-001) Avail: NTIS HC A03/MF A01 CSCL 21/8

An experimental investigation was conducted to determine the feasibility and practicality of the dual chamber rocket concept. Cold flow studies were performed which utilized a telescoping booster cavity. The effects of booster cavity length, booster cavity shockdown pressure, booster/sustainer nozzle area ratio, and aft nozzle removal on thrust and the booster cavity pressure distribution were explored. Author (GRA)

N79-25059*# Aerojet Electrosystems Co., Azusa, Calif.
BACKFLOW CONTAMINATION FROM SOLID ROCKET MOTORS
C. R. Maag *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 332-346 refs (For primary document see N79-25048 16-12)
(Contract F04701-77-C-0010)
Avail: NTIS HC A99/MF A01 CSCL 21H

N79-25060*# Aerojet Electrosystems Co., Azusa, Calif.
CONTAMINATION MECHANISMS OF SOLID ROCKET MOTOR PLUMES
M. K. Barsh, J. A. Jeffery, P. Brestyanszky, and K. J. Adams *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 347-384 refs (For primary document see N79-25048 16-12)
(Contract F04701-77-C-0010)
Avail: NTIS HC A99/MF A01 CSCL 21H

N79-25064*# ARO, Inc., Arnold Air Force Station, Tenn.
EXHAUST PLUME CONTAMINANTS FROM AN AGED HYDRAZINE MONOPROPELLANT THRUSTER
T. D. McCay, D. P. Weaver, W. D. Williams, H. M. Powell, and J. W. L. Lewis *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 456-517 refs (For primary document see N79-25048 16-12)
Avail: NTIS HC A99/MF A01 CSCL 21H

N79-25065*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DESIGN OF A PROPULSION SYSTEM TEST FACILITY TO STUDY ROCKET PLUMES IN THE SPACE ENVIRONMENT
L. F. Molinari *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 518-532 refs (For primary document see N79-25048 16-12)

(Contract NAS7-100)
Avail: NTIS HC A99/MF A01 CSCL 21H

N79-25072*# Arnold Engineering Development Center, Arnold Air Force Station, Tenn.
BIPROPELLANT ENGINE PUMP STUDY
H. E. Scott, D. F. Frazine, and E. G. Lund (Air Force Rocket Propulsion Lab., Edwards AFB, Calif.) *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 682-740 refs (For primary document see N79-25048 16-12)
Avail: NTIS HC A99/MF A01 CSCL 21H

N79-25073*# Aerojet Electrosystems Co., Azusa, Calif.
GROUND CONTAMINATION MONITORING METHODS
C. R. Maag and R. R. Scott *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 741-762 refs (For primary document see N79-25048 16-12)
Avail: NTIS HC A99/MF A01 CSCL 20H

N79-25076*# ARO, Inc., Arnold Air Force Station, Tenn.
ALUMINUM OXIDE PARTICLES PRODUCED BY SOLID ROCKET MOTORS
R. Dawbarn *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 809-845 refs (For primary document see N79-25048 16-12)
Avail: NTIS HC A99/MF A01 CSCL 21H

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N79-25137 Stanford Univ., Calif.
THE PHOTODISSOCIATION OF ORGANIC CATIONS IN THE GAS PHASE Ph.D. Thesis
Robert Gooden 1979 150 p
Avail: Univ. Microfilms Order No. 7912364

The low energy resolution photodissociation spectra and extent of light induced reactions of some organic cations were studied employing the ICR spectrometer and results were applied to a further understanding of the spectroscopy and reaction dynamics of organic cations in the gas phase. The photodissociation reactions of aromatic carbonyl cations, especially butyrophenone molecular ion, appear to be analogous to the mass spectral and photochemical reactions of the neutrals. These reactions are strongly energy dependent and appear to occur from specific electronic states. The molecular cation of nitrobenzene photodissociated by cleavage and rearrangement displays reactions similar to the behavior of butyrophenone. The photodissociation of trans-stilbene radical cation can be explained by a mechanism involving trans-cis isomerism and ring cyclization before fragmentation, analogous to neutral photochemical reactions.
Dissert. Abstr.

N79-25138 Illinois Univ. at Urbana-Champaign, Urbana.
ANALYSIS OF ORGANIC THIN FILMS Ph.D. Thesis
David Roth Eaton 1978 161 p
Avail: Univ. Microfilms Order No. 7913438

The interfaces of two components in a multilayer thin film system were examined. The films were encapsulated in epoxy, cross-sectioned via ultramicrotomy and examined via transmission electron microscopy. Observations of metal/zinc phthalocyanine/metal film systems revealed sharply defined metal/zinc phthalocyanine interfaces. Pinholes in the intervening zinc phthalocyanine layer were revealed for the first time. A nitrogen laser was built to serve as a laser microprobe. Both optical and mass spectrometric detection were used to examine the material etched by the laser microprobe. Scanning electron microscopy, and the scanning Auger microprobe were used to examine the effects of the laser beam on the organic and metallic samples used. On bulk metal samples, the laser appears to remove material by a melting/vaporizing mechanism. Dissert. Abstr.

N79-25139 Oklahoma State Univ., Stillwater.
ELECTRON PARAMAGNETIC RESONANCE ANALYSIS OF PROTEIN-LIPID INTERACTIONS Ph.D. Thesis
Mark Edward Markes 1978 185 p
Avail: Univ. Microfilms Order No. 7912640

Electron paramagnetic resonance was used to characterize the intrinsic paramagnetism of quick frozen liver tissue and to examine the interaction of erythrocyte spectrin with various phospholipid systems. The systems examined included whole liver tissue frozen in liquid nitrogen, some specimens of which had been treated with boric acid or Rotenone; hemolyzed human erythrocyte membranes; and liposomes of synthetic phospholipids associated with spectrin. The spectrin was isolated from human erythrocytes and characterized by polyacrylamide gel electrophoresis. Lipid regions of the protein-lipid systems were studied using fatty acid spin probes, and protein-binding was characterized by density gradient centrifugation and electron microscopy. In the synthetic lipid systems particular attention was given to the variation of spin probe mobility with temperature. Dissert. Abstr.

N79-25140 Medical Coll. of Virginia, Richmond.
NEAREST NEIGHBOR COOPERATIVE PHENOMENA IN HETEROGENEOUS SYSTEMS Ph.D. Thesis
John Stewart Shiner 1978 203 p
Avail: Univ. Microfilms Order No. 7904285

An approach is generalized to heterogeneous multicomponent systems with more than one chemical degree of freedom in both the equilibrium and quasi-equilibrium steady state regimes so that it might be applicable to such problems as the effects of other ligands on the binding of the one of primary interest, the effects of modifiers on enzyme catalysis, and the effects of modulators of contractile activity. Dissert. Abstr.

N79-25141# Rhode Island Univ., Kingston. Dept. of Chemistry.
EVALUATION AND CLASSIFICATION OF THE ELECTRICAL HAZARD OF CHEMICAL VAPORS DURING WATER TRANSPORTATION USING PATTERN RECOGNITION TECHNIQUES Final Report
James L. Fasching, Earl W. Stromberg, and Clifford P. Weisel Jan. 1979 91 p refs
(Contract DOT-CG-44160-A)
(AD-A066982; USCG-D-16-79) Avail: NTIS HC A05/MF A01 CSCL 07/1

Pattern recognition is a statistical technique that allows one to find or predict a property of chemicals that is not directly measurable, but is known to depend upon certain features or properties of the chemicals via some totally unknown relationship. This technique has been applied to a multitude of scientific problems. The same technique was used to classify a chemical according to its relative hazard in bulk water-transportation based on chemical structure and macro-scale properties such as density, vapor pressure, structure-fragments, solubilities, etc. Using the Linear-Learning Machine, the overall prediction of the 47 compounds in training set was 68% correct. The predicted classifications of the 240 compounds in the test set are approximately 68% correct. There are many difficulties associated with properly classifying compounds on the basis of variable derived from structural fragments that must be solved before great reliance can be placed on the results of a Linear-Learning Machine classification. Author (GRA)

N79-25050*# Aerojet Electrosystems Co., Azusa, Calif.
A MULTINODAL MODEL FOR SURFACE CONTAMINATION BASED UPON THE BOLTZMANN EQUATION OF TRANSPORT
E. A. Zeiner *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 14-33 refs (For primary document see N79-25048 16-12)
Avail: NTIS HC A99/MF A01 CSCL 07A

24 COMPOSITE MATERIALS

Includes laminates.

N79-25142* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THERMAL INSULATION PROTECTION MEANS Patent

Robert L. Dotts, James A. Smith, and George Strouhal, inventors (to NASA) Issued 1 May 1979 7 p Filed 15 Apr. 1977 Supersedes N77-22423 (15 - 13, p 1721)
(NASA-Case-MSC-12737-1; US-Patent-4,151,800; US-Patent-Appl-SN-788045; US-Patent-Class-102-105; US-Patent-Class-244-121; US-Patent-Class-244-163; US-Patent-Class-427-350; US-Patent-Class-427-372A; US-Patent-Class-428-137; US-Patent-Class-428-282; US-Patent-Class-428-290; US-Patent-Class-428-332; US-Patent-Class-428-447; US-Patent-Class-428-920) Avail: US Patent and Trademark Office CSCL 11D

A system for providing thermal insulation for portions of a spacecraft which do not exceed 900 F during ascent or reentry relative to the earth's atmosphere is described. The thermal insulation is formed of relatively large flexible sheets of needled Nomex felt having a flexible waterproof coating. The thickness of the felt is sized to protect against projected temperatures and is attached to the structure by a resin adhesive. Vent holes in the sheets allow ventilation while maintaining waterproofing. The system is heat treated to provide thermal stability.

Official Gazette of the U.S. Patent and Trademark Office

N79-25143* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
BONDING OF SAPPHIRE TO SAPPHIRE BY EUTECTIC MIXTURE OF ALUMINUM OXIDE AND ZIRCONIUM OXIDE Patent
John J. DeLuca, inventor (to NASA) Issued 22 May 1979 5 p Filed 30 Dec. 1975 Supersedes N76-19234 (14 - 10, p 1229) Continuation-in-part of abandoned US Patent Appl. SN-506803, filed 17 Sep. 1974, which is a division of US Patent Appl. SN-322997, filed 12 Jan. 1973, US-Patent-3,859,714
(NASA-Case-GSC-11577-3; US-Patent-4,155,475; US-Patent-Appl-SN-645502; US-Patent-Class-220-2.2; US-Patent-Class-65-43; US-Patent-Class-156-89; US-Patent-3,859,714; US-Patent-Appl-SN-506803; US-Patent-Appl-SN-322997) Avail: US Patent and Trademark Office CSCL 11D

An element comprising sapphire, ruby or blue sapphire can be bonded to another element of such material with a eutectic mixture of aluminum oxide and zirconium oxide. The bonding mixture may be applied in the form of a distilled water slurry or by electron beam vapor deposition. In one embodiment the eutectic is formed in situ by applying a lasdr of zirconium oxide and then heating the assembly to a temperature above the eutectic temperature and below the melting point of the material from which the elements are formed. The formation of a sapphire rubidium maser cell utilizing eutectic bonding is shown.

Official Gazette of the U.S. Patent and Trademark Office

N79-25144*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
STRAIN COMPATIBILITY ASSESSMENT FOR SRB SPRAYABLE ABLATOR MSA-1
William J. Patterson Apr. 1979 45 p
(NASA-TM-78228) Avail: NTIS HC A03/MF A01 CSCL 11D

Tensile and compressive strain compatibility testing was performed on as-sprayed samples of the Shuttle Solid Rocket Booster external ablator material, MSA-1. Strain gages on the aluminum substrate were used to monitor strain. Strain compatibility was determined as the percent strain in the substrate at first visual evidence of MSA-1 failure. The 1/8-in. MSA-1, baselined for large areas of the SRB external skin, was characterized by a strain compatibility of 1.5 to 1.8 percent, which far exceeded the yield range of the metal substrate. Thicker MSA-1 applications (1.4 to 3/8 in.) were characterized by a lower level of strain compatibility, which appeared to be a manifestation of application limitations. Author

N79-25145*# United Technologies Research Center, East Hartford, Conn.
STUDY OF HIGH RESISTANCE INORGANIC COATINGS ON GRAPHITE FIBERS Interim Report
F. S. Galasso, R. D. Veltri, and D. A. Scola Jun. 1979 128 p refs
(Contract NAS1-14346)
(NASA-CR-159078; R79-914212-9) Avail: NTIS HC A07/MF A01 CSCL 11D

Coatings made of boron, silicon carbide, silica, and silica-like materials were studied to determine their ability to increase resistance of graphite fibers. The most promising results were attained by chemical vapor depositing silicon carbide on graphite fiber followed by oxidation, and drawing graphite fiber through ethyl silicate followed by appropriate heat treatments. In the silicon carbide coating studies, no degradation of the graphite fibers was observed and resistance values as high as three orders of magnitude higher than that of the uncoated fiber was attained. The strength of a composite fabricated from the coated fiber had a strength which compared favorably with those of composites prepared from uncoated fiber. For the silica-like coated fiber prepared by drawing the graphite fiber through an ethyl silicate solution followed by heating, coated fiber resistances about an order of magnitude greater than that of the uncoated fiber were attained. Composites prepared using these fibers had flexural strengths comparable with those prepared using uncoated fibers, but the shear strengths were lower. A.R.H.

N79-25146*# Union Carbide Corp., Parma, Ohio. Carbon Products Div.
MODIFIED CARBON FIBERS TO IMPROVE COMPOSITE PROPERTIES Final Report
R. E. Shepler Jun. 1979 77 p
(Contract NAS1-15283)
(NASA-CR-159057) Avail: NTIS HC A05/MF A01 CSCL 11D

Thin coatings, 5 to 10 wt. percent, were applied to PAN-based carbon fibers. These coatings were intended to make the carbon fibers less electrically conductive or to cause fibers to stick together when a carbon fiber/epoxy composite burned. The effectiveness of the coatings in these regards was evaluated in burn tests with a test rig designed to simulate burning, impact and wind conditions which might release carbon fibers. The effect of the coatings on fiber and composite properties and handling was also investigated. Attempts at sizing carbon fibers with silicon dioxide, silicon carbide and boron nitride meet with varying degrees of success; however, none of these materials provided an electrically nonconductive coating. Coatings intended to stick carbon fibers together after a composite burned were sodium silicate, silica gel, ethyl silicate, boric acid and ammonium borate. Of these, only the sodium silicate and silica gel provided any sticking together of fibers. The amount of sticking was insufficient to achieve the desired objectives. A.R.H.

N79-25147# Chemetal Corp., Pacoima, Calif.
INVESTIGATION OF THE CNTD MECHANISM AND ITS EFFECT ON MICROSTRUCTURE AND PROPERTIES OF SILICON NITRIDE Final Summary Report, Jul. 1978 - Jul. 1979
Robert A. Holzl Sep. 1978 40 p refs
(Contract N00019-77-C-0395)
(AD-A067225) Avail: NTIS HC A03/MF A01 CSCL 11/2

Silicon carbide and silicon nitride have been recognized as prime candidate materials for numerous high temperature applications, based on their properties such as oxidation resistance, chemical stability, creep resistance, strength, and thermal shock resistance. As a result, a number of different consolidation techniques are being investigated for potential use. Ceramics produced by CVD are thought to have considerable potential in these applications in offering greater purity and density than ceramics produced by more conventional consolidation techniques. At Chemetal, an advanced state of the art CVD process, called Controlled Nucleation thermochemical Deposition has been developed. The influence of the process on the microstructures is readily apparent. The characteristics of the resultant deposit are quite different in that the columnar crystal growth, which is typical of CVD, is interrupted so as to provide instead a fine grained non-columnar deposit. This program was directed toward achieving a better understanding of the mechanism of the CNTD process as it relates to silicon nitride deposition. GRA

N79-25148# Texas A&M Univ., College Station. Mechanics and Materials Research Center.
COMPOSITE MATERIALS FOR STRUCTURAL DESIGN Annual Technical Report, 15 Jan. 1978 - 14 Jan. 1979

Richard Schapery Mar. 1979 153 p refs
(Contract F49620-78-C-0034)
(AD-A066754; MM-3724-79-2; AFOSR-79-0347TR; ATR-1)
Avail: NTIS HC A08/MF A01 CSCL 11/4

Summarized are research activities in the areas of composite materials processing and testing, elevated temperature and moisture effects on composites and adhesives, and neutron radiography. Also included are four papers which were completed during the reporting period. Primary accomplishments in the first area were the development of a processing laboratory, development of a testing method for obtaining the complex modulus of resin during the curing process, and partial characterization of thermo mechanical behavior of resins and composites close to and below the glass transition temperature. Some methods for predicting residual stresses and crack growth in composites were developed, and special cases were studied. Also, nonlinear constitutive equations were incorporated into a finite element code. A neutron radiography facility was developed and applied to the inspection of moisture content and flows in composites.
Author (GRA)

N79-25149# Southwest Research Inst., San Antonio, Tex.
DAMAGE MECHANISMS AND FAILURE OF 3-D CARBON-CARBON COMPOSITES Interim Report, Aug. 1977 - Aug. 1978
Philip H. Francis and Craig T. Robinson Feb. 1979 94 p refs
(Contract N00014-77-C-0510)
(AD-A066649; SWRI-02-4982) Avail: NTIS HC A05/MF A01 CSCL 11/4

Mechanical property characterization tests were conducted on specimens from a three-dimensional, cartesian orthogonally woven carbon-carbon (C-C) material. Tests consisted of tensile and rail shear, which were conducted at room temperature, and compression tests conducted at room temperature up to 2165 C (3930 F). Stress-strain characteristics and acoustic emission instrumentation were employed to infer the mechanics of the fracture initiation process. In addition, a specially developed axial loading stage integral to SwRI's ETEC scanning electron microscope facility was used to view and videotape the crack initiation and development processes. As a result of these studies, a tentative model is described to explain the mechanics of failure in 3-D C-C composites. Author (GRA)

N79-25150# Army Materials and Mechanics Research Center, Watertown, Mass.
FRACTURE OF GRAPHITE COMPOSITES UNDER SHOCK LOADING Final Report
Elizabeth C. Goeke and Frank A. McClintock (MIT, Cambridge, Mass.) Dec. 1978 60 p refs Submitted for publication
(AD-A067198; AMMRC-TR-78-49) Avail: NTIS HC A04/MF A01 CSCL 11/2

A previously obtained set of experimental data on the failure of three-dimensional graphite composites under shock loading was examined. The critical event was determined to be fracture in the fiber bundles parallel to the shock direction. Physical considerations, as well as a simple approximation equation and a computer model of the fiber bundle fracture, show rather definitely that for pulse widths less than 0.5 microsec the variability in the strength of the individual fibers is the primary cause of the observed stress-pulse width relationship. The assumptions of the computer model include a static stress concentration around the broken fibers and a fiber strength described by an extreme value distribution. Author (GRA)

N79-25151# Army Materials and Mechanics Research Center, Watertown, Mass.
CURE ANALYSIS OF EPOXY COMPOSITES USING FOURIER TRANSFORM INFRARED SPECTROSCOPY Final Report
James F. Sprouse, Bernard M. Halpin, Jr., and Robert E. Sacher Nov. 1978 26 p refs
(AD-A067197; AMMRC-TR-78-45) Avail: NTIS HC A03/MF A01 CSCL 11/9

Fourier transform infrared spectroscopy (FT-IR) has been used to measure the extent of cure in fiber-reinforced epoxy composites and the corresponding resin matrixes. Two sampling techniques have been used to study the curing processes: (1) thin films of neat resin held between salt plates and (2) internal reflectance spectroscopy (IRS). Thin films have been studied by curing them in a temperature-controlled cell that allowed the same temperature program to be followed that was used in the corresponding composite fabrication. Infrared spectra were recorded at short time intervals throughout the cure cycle and the results were used to measure extent of cure based on epoxide ring absorbance at approximately 915 wave numbers. Internal reflectance measurements were performed on the corresponding composite materials and results were compared with the thin film measurements. GRA

N79-25051*# Lockheed Missiles and Space Co., Palo Alto, Calif.
OUTGASSING RATE OF MULTILAYER INSULATION
A. P. M. Glassford and C. K. Liu *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 83-106 refs (For primary document see N79-25048 16-12)
Avail: NTIS HC A99/MF A01 CSCL 11D

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

N79-25152 Illinois Inst. of Tech., Chicago.
THEORETICAL STUDIES OF GAS-SOLID INTERACTIONS Ph.D. Thesis
Charles James Ray 1978 126 p
Avail: Univ. Microfilms Order No. 7913107

A quasiclassical trajectory method for describing elastic diffraction scattering of an atom from a crystal surface was developed and applied to the He-LiF(001) system. In the quasiclassical analysis of the scattering, the change in the x and y components of the gas atom are quantized by a prescription derived from the surface diffraction equation. These quantized momentum changes correspond to the various diffraction channels. Dissert. Abstr.

N79-25153 Illinois Univ. at Urbana-Champaign.
RAMAN STUDIES OF RELAXATION MECHANISMS IN DENSE FLUIDS: HYDROGEN-BONDED AND NON-INTERACTING SYSTEMS Ph.D. Thesis
Valeria Hales Schiemann 1978 158 p
Avail: Univ. Microfilms Order No. 7913603

Raman spectroscopy can provide much information about relaxation mechanisms in dense fluids. The use of pressure in addition to temperature as a variable permits separation of the effect of density and temperature on the system, which was shown to be of importance in several earlier studies. Two compounds were studied in some detail in this work: methanol and carbon tetrafluoride. Dissert. Abstr.

N79-25154 Georgia Univ., Athens.
THE VINYL TORSION IN CONJUGATED MOLECULES: STUDIES IN LOW FREQUENCY RAMAN SPECTROSCOPY Ph.D. Thesis
Theodore Gould Towns 1978 142 p
Avail: Univ. Microfilms Order No. 7914063

There are two principal conclusions to be reached on the basis of the studies reported. First, although there are a variety of physical methods available for probing conformational equilibria, examination of a compound's Raman spectrum, particularly in the low frequency region, is shown to be one of the most direct methods. And secondly, resonance stabilization, produced by co-planarity of unsaturated moieties in the compound, is the dominant force in determining the conformational preferences in organic molecules. Dissert. Abstr.

N79-25155 Baylor Univ., Houston, Tex.
PRACTICAL DEVELOPMENTS IN ANALYTICAL FLAME SPECTROMETRY Ph.D. Thesis

Dale Francis Brost 1978 129 p
Avail: Univ. Microfilms Order No. 7912499

The high-accuracy determination of serum lithium by optically monitored stable isotope dilution was obtained by the development of a simplified atomic absorption procedure for the isotopic analysis of trace amounts of lithium. The fundamental difficulty of such measurements, i.e., the direct overlap of the Li-6 and Li-7 components of the 670.8 nm atomic resonance line, is solved by the application of the well established UV/VIS procedure for the simultaneous determination of analyte species with overlapping spectra. The isotopic analysis method is applicable over a wide range of isotopic composition, is independent of concentration with respect to total lithium content, and is completely free of matrix-related systematic error. A composite response parameter for the determination of optimum compromise excitation conditions in simultaneous multielement flame spectrometry is described. Dissert. Abstr.

N79-25156 Florida Univ., Gainesville.
ELECTROLYTE BEHAVIOR SOLVENTS OF HIGH DIELECTRIC CONSTANT Ph.D. Thesis
Richard Alan Butler 1978 123 p
Avail: Univ. Microfilms Order No. 7913256

The thermodynamic properties of hydrobromic acid (HBr), acetic acid (HAc), and protonated tris-(hydroxymethyl) aminomethane (TrisH+) were determined in solvent mixtures composed of water and N-methylacetamide, by means of emf measurements of cells without transport. All measurements were made using hydrogen electrodes and silver-silver bromide electrodes. The standard free energy changes for the transfer of the HAc and TrisH+ dissociations from water to the high dielectric constant mixtures show trends which contradict a purely electrostatic model for electrolyte dissociation. The trends are remarkably similar to those which are observed on transfer to lower dielectric constant media. The results further demonstrate the importance of solute-solvent interactions in determining electrolyte equilibria. The standard transfer enthalpies and entropies are discussed in terms of solute-solvent effects present in these ionic systems. Dissert. Abstr.

N79-25157 Georgia Univ., Athens.
ENZYME CHARACTERIZATION BY PYROLYSIS GAS CHROMATOGRAPHY AND BY COMPUTER-CONTROLLED REACTION-RATE MEASUREMENTS Ph.D. Thesis
Neil David Danielson 1978 121 p
Avail: Univ. Microfilms Order No. 7914022

Pyrolysis gas chromatography was used to differentiate alpha-chymotrypsin, lactate dehydrogenase, catalase, and urease were on a 1.8 m 0.5% Carbowax 20 M column. In some cases, isoenzymes of lactate dehydrogenase could be distinguished. Based on the pyrolyses of the free aromatic amino acids, four major enzyme pyrolysis peaks were tentatively identified as organic compounds derived from tyrosine and tryptophan. Tryptophan in proteins was directly determined by pyrolysis of the dry solids followed by gas chromatographic separations of skatole produced from the tryptophanyl moieties. The effect of sodium chloride, over a wide range of ionic strengths, on the pyruvate Michaelis constant of several different isoenzymes of mammalian lactate dehydrogenase (LDH) was determined. In addition, one of those LDH isoenzymes was immobilized onto Glycophase controlled-pore-glass. Dissert. Abstr.

N79-25158 Illinois Univ. at Urbana-Champaign, Urbana.
NMR STUDIES OF LIQUIDS AND DISORDERED SOLIDS AT HIGH PRESSURE Ph.D. Thesis
Michael Andrew Fury 1978 165 p
Avail: Univ. Microfilms Order No. 7913463

The viscosity dependence of the reorientation correlation time for ten liquids is evaluated using the hydrodynamic Debye equation, the empirical factor kappa introduced by McClung and Kivelson, and the zero-viscosity correlation time kappa is strongly correlated with the molecular shape, and an empirical method of estimating kappa is presented. A number of theoretical methods for predicting kappa are also evaluated. Spin-lattice relaxation times are reported for solid cyclohexane in its plastic and brittle phases. The phase transition at elevated pressure is not completely analogous to the phase transition at atmospheric pressure, as it is in adamantane. The pressure dependence of T sub 1 indicates the presence of a separate high pressure phase. Dissert. Abstr.

N79-25159 California Univ., Los Angeles.
STUDIES IN A DIFFUSION CLOUD CHAMBER: RADICAL PHOTOCHEMISTRY, AEROSOL DYNAMICS Ph.D. Thesis
Alan William Gertler 1979 105 p
Avail: Univ. Microfilms Order No. 7913722

A model is outlined in which the production of large involatile alkanes are formed from an initially produced nonane radical. These results are combined with binary nucleation theory in order to calculate the effect of these species on the rate of nucleation. Low concentrations of these involatile species can induce nucleation. The ability of small, photochemically produced polymers to induce nucleation is also examined and the time dependent space distribution of polymers generated by chain transfer from a single free radical is derived. The diffusion cloud chamber is used to qualitatively study some dynamic properties of liquid drops by suspending them in an electric field at the plane of saturation. By varying the strength of the electric field, it is possible to change the size of the suspended droplets and even, if desired, to isolate a single drop. Dissert. Abstr.

N79-25160 Minnesota Univ., Minneapolis.
INFRARED REFLECTION-ABSORPTION SPECTROSCOPY Ph.D. Thesis
William Glen Golden 1978 225 p
Avail: Univ. Microfilms Order No. 7912009

Good quality infrared reflection-absorption spectra of molecules adsorbed in monolayer and submonolayer concentrations on low-area metal surfaces resulted from improvements in previous spectrometer designs and techniques which allow the infrared reflection-absorption spectra of adsorbed molecules to be obtained over a range of adsorber gas pressures from 10 to the -9th power torr to 100 torr. The system CO on W(110), under ultra-high vacuum conditions, is examined. It Appears that the alpha-CO structure is linear, and that the beta-CO state is dissociatively adsorbed. Further, there is evidence of interconversion between the alpha 2-CO state and the beta states during thermal desorption. Studies of CO adsorbed on either oxidized or reduced Pt(111) surfaces in the presence of high CO gas-phase pressures and preliminary results for the system NH3 on Pt(111) are discussed. Dissert. Abstr.

N79-25161 University of Northern Illinois, De Kalb.
DOUBLE PULSE COULOSTATICS Ph.D. Thesis
Michael Lawrence Mchalsky 1978 193 p
Avail: Univ. Microfilms Order No. 7912489

Double pulse coulostatics is a two step perturbation technique. The first perturbation causes the diffusion controlled electrochemical reaction of the initial species and a second, opposite perturbation causes the products of the first reaction to reform the original reactant. The double pulse coulostatic technique was applied to simple electrochemical systems and systems complicated by homogeneous chemical reactions. The results obtained were consistent with those given in the literature, and they indicate that the technique is limited only by the present instrumentation. Dissert. Abstr.

N79-25162 Illinois Univ. at Urbana-Champaign, Urbana.
QUANTITATIVE ASPECTS OF SECONDARY ION MASS SPECTROMETRY Ph.D. Thesis
Vaughn Robert Deline 1978 109 p
Avail: Univ. Microfilms Order No. 7913425

Secondary ion mass spectrometry (SIMS) is the most sensitive of the microanalytical techniques currently available for materials characterization. To take advantage of this unique capability quantitative procedures must be developed and employed. Ion implantation was extensively used in this study to obtain characterized concentrations of impurity elements in the matrices of interest. Controlled amounts of a specific element can be introduced into the surface region of a sample by accelerating ions of the desired element to energies sufficient to penetrate the outer surface layers and come to rest well within the matrix (100 to 10,000 Am). A subsequent SIMS depth profile of such a sample results in a calibrated concentration scale and secondary ion detection limit for the implanted element. Dissert. Abstr.

N79-25163 Illinois Univ. at Urbana-Champaign, Urbana.
RECTIFYING PROPERTIES, PHOTOVOLTAIC EFFECTS, AND ELECTROCHEMICAL STUDIES OF PHTHALOCYANINE THIN FILMS Ph.D. Thesis
Fu-Ren Frank Fan 1978 176 p
Avail: Univ. Microfilms Order No. 7913449

The electrical properties of thin film sandwich cells (M/Pc/Au) were studied in a quantitative fashion. Rather strong photovoltaic effect is observed for these sandwich cells. Electrochemical studies were made of phthalocyanine surfaces. The electrodes were fabricated by evaporating about 40 A of chromium, 300 A of gold, and 250 - 3000 A of a phthalocyanine, in sequence, onto a glass substrate in vacuo. Metal free, zinc, and nickel phthalocyanines, were examined. Electron transfer via interfacial states plays an important role at phthalocyanine thin film electrodes. Cathodization process via interfacial states seems more faborable at ZnPc electrodes than at H2Pc electrodes since the electron exchange between the interfacial states and the conduction band is faster in ZnPc system than in H2Pc system. Dissert. Abstr.

N79-25164 Georgia Univ., Athens.
COMPUTER-AIDED STUDIES OF CHROMATOGRAPHIC INSTRUMENTATION Ph.D. Thesis
Joseph Louis Glajch 1978 216 p
Avail: Univ. Microfilms Order No. 7914027

Four studies of instrumentation in chromatography using an on line computer are presented. Included are: (1) nitrogen response mode of the thermonic rubidium silicate detector; (2) pyrolysis gas chromatography to study 12 coal and petroleum pitches used as binders and impregnants in the production of thermionic electrodes; (3) the effect of solute molecular weight, flow rate, added dead volume, and different detectors on peak shape in a gel permeation system; and (4) the test and design of a recycle gas chromatography which operates under computer control. Dissert. Abstr.

N79-25165 State Univ. of New York at Buffalo.
VOLTAMMETRIC STUDIES OF NITRIC-OXIDE AND NITROGEN-DIOXIDE, PART 1. REAL TIME COMPENSATION OF CHARGING CURRENTS AT A DROPPING MERCURY ELECTRODE, PART 2 Ph.D. Thesis
John Anthony Kosek 1979 327 p
Avail: Univ. Microfilms Order No. 7913896

The electrochemistry of nitrogen dioxide and nitric oxide were studied. Comparisons between solutions of nitrogen dioxide and sodium nitrite on rotating gold disc electrodes showed the electroactive species, in both cases, was the nitrite ion. Equations were derived for the real time compensation of charging currents at a dropping mercury electrode. By using a combination of Tast polarography and the general case of the compensation theory, an optimum compensation expression was obtained. Experimental results used to verify the theoretical expressions were obtained for both supporting electrolyte alone and solutions containing either cadmium or thallium. Using this compensation technique the lower limit of detection was less than .000001N. Dissert. Abstr.

N79-25166 Illinois Univ. at Urbana-Champaign, Urbana.
ELECTROHYDRODYNAMIC IONIZATION MASS SPECTROMETRY Ph.D. Thesis
Shook Tsang Francis Lai 1978 115 p
Avail: Univ. Microfilms Order No. 7913522

Sodium hydroxide-glycerol studies and an analysis of salt mixtures are present as well as research on thermally labile, nonvolatile organic materials. In the electrolyte studies, the EH recorded the reaction products of the acid base reaction between glycerol and sodium hydroxide. The EH mass spectrum reflected the ion ratios in solution. Sixteen organic compounds were studied. Techniques like the use of acid to enhance ion formation, the use of negative ion mass spectrometry for salts with organic anions and the use of two solvents for molecular weight determination were introduced. The resulting sample mass spectra indicate that EH is applicable to the studies of solvent-sample-electrolyte interactions. Dissert. Abstr.

N79-25167 New Mexico Univ., Albuquerque.
HOLLOW CATHODE ATOMIZATION FOR ATOMIC ABSORPTION SPECTROMETRY, AN ANALYTICAL STUDY INCLUDING MATRIX EFFECTS AND PLASMA CHARACTERIZATION Ph.D. Thesis
David Allen Mccamey 1978 158 p
Avail: Univ. Microfilms Order No. 7912935

Plasma studies were conducted in which several species previously not directly studied in the hollow cathode discharge were monitored using absorption of light as the probe. The relative concentrations of metastable noble gas atoms as well as sputtered metal atoms and ions were recorded as a function of fill gas pressure and discharge current. The effects of a changing ground state population were accounted for and the relative excitation efficiency of the discharge was calculated. The metastable fill gas atoms may play an important role in the ionization of the sputtered material. These metastables affect the excitation of species in the plasma only in an indirect and negative way. These and other observations about the hollow cathode discharge and plasma are discussed. Dissert. Abstr.

N79-25168 Illinois Univ. at Urbana-Champaign, Urbana.
A NEW APPROACH TO THE THEORETICAL AND EXPERIMENTAL TREATMENT OF ELECTROGENERATED CHEMILUMINESCENCE Ph.D. Thesis
Jerry Lee Morris, Jr. 1978 175 p
Avail: Univ. Microfilms Order No. 7913554

A treatment of the reaction zone for electrogenerated chemiluminescence (ECL) was developed using a digital simulation technique. The detailed reaction zone treatment has been used to provide a more rigorous, mathematical, test of the plausibility of the current interpretation of magnetic field effects in ECL. The results indicate that the interpretation is self consistent, but that effects other than merely intensity enhancement may be manifest depending on the triplet lifetime. Dissert. Abstr.

N79-25169 Florida Univ., Gainesville.
DESIGN AUTOMATION, AND OPTIMIZATION OF A WAVELENGTH MODULATED MULTIELEMENT ATOMIC EMISSION/FLUORESCENCE SPECTROMETER SYSTEM Ph.D. Thesis
Bruce Douglas Pollard 1978 189 p
Avail: Univ. Microfilms Order No. 7913311

A computer controlled multielement flame atomic emission/fluorescence spectrometer, suitable for analytical studies of noise sources, flames, modulation methods, and the statistics of error propagation, was designed around a programmable slew-scan monochromator. Continuum radiation from an Eimac xenon arc lamp is used for fluorescence excitation in a flame (most commonly air/acetylene or nitrous oxide/acetylene). Atomic fluorescence and emission signals are collected simultaneously via wavelength modulation. Synchronous photon counting is employed for sensitivity and for easy statistical treatment of signals. The entire system except for flame flow rates and sample introduction is under PDP 11 minicomputer control. Machine language functions for controlling the integration time and reading data from the photon counter and for choosing a wavelength, callable from BASIC, are described as well as the implementation of wavelength modulation. Dissert. Abstr.

N79-25170 Florida Univ., Gainesville.
OPTIMIZATION OF SIGNAL-TO-NOISE RATIOS IN ANALYTICAL SPECTROMETRY: THE EXTERNAL HEAVY ATOM EFFECT IN PULSED LASER TIME-RESOLVED PHOSPHORIMETRY Ph.D. Thesis
Glenn David Boutilier 1978 194 p
Avail: Univ. Microfilms Order No. 7913252

A treatment of noise and signal-to-noise ratios of paired readings is given for additive and multiplicative noise using the relation between the autocorrelation function and the spectral noise power. Radiance expressions are developed for molecular luminescence in terms of steady state and nonsteady state concentrations. A pulsed source time resolved phosphorimeter is described. A nitrogen laser and a flashlamp pumped dye laser are used as excitation sources and compared with respect to limits of detection for benzophenone, quinine, and phenanthrene. The external heavy atom effect has been studied using iodide, silver, and thallous ions as external heavy atom perturbers in an ethanol and water solvent at 77 K. Phosphorescence lifetimes and relative intensities for carbazole, phenanthrene, quinine,

7,8-benzoflavone, and thiopropazate are given and the mechanism of the external heavy atom effect is discussed. Dissert. Abstr.

N79-25171 Florida Univ., Gainesville.
CONTINUOUS WAVE LASER EXCITED ATOMIC AND MOLECULAR FLUORESCENCE Ph.D. Thesis
Marlana Beth Blackburn 1978 76 p
Avail: Univ. Microfilms Order No. 7913250

The tunable continuous wave (CW) dye laser is used to saturate the 589.6 nm transition of sodium in two flames of different efficiency. A quantum three level model is used to compare theoretical and experimental results. Plots of absolute fluorescence radiance vs. source irradiance are presented for source intensities varying over six orders of magnitude. The agreement between theory and experiment is quite good. The CW dye laser has also beem used as an excitation source for molecular fluorescence. Fluorescence spectra of five species were recorded: SrOH, CaOH, CrO, MnO, and C2. Differences in the fluroescence spectra as a function of excitation wavelength are investigated. Dissert. Abstr.

N79-25172 Massachusetts Univ., Amherst.
THEORETICAL AND EXPERIMENTAL INVESTIGATION OF THE INDUCTIVELY COUPLED ARGON PLASMA AS A SPECTROCHEMICAL SOURCE Ph.D. Thesis
Robert Gerard Schleicher 1979 348 p
Avail: Univ. Microfilms Order No. 7912710

The results of theoretical and experimental investigations of the inductively coupled argon plasma spectrochemical source are presented. A mathematical model of the source is developed which permits prediction of plasma temperature fields, velocity fields, and energy loss distributions. In a second mathematical model, based on previously calculated temperature and velocity fields, the decomposition of aluminum oxide particles injected into the plasma is simulated. The degree of decomposition is studied as a function of particle diameter and plasma operating conditions. In addition, aluminum line and argon continuum radiation profiles are calculated. Experimental radial temperature profiles of the plasma sources are presented as a function of axial position and source operating condition. Discharge gas velocities are also reported. Dissert. Abstr.

N79-25173 Illinois Univ. at Urbana-Champaign, Urbana.
MAGNETIC EXCHANGE IN FIVE-COORDINATE COPPER (II) SYSTEMS Ph.D. Thesis
David Steven Bieksza 1978 261 p
Avail: Univ. Microfilms Order No. 7913386

Paramagnetic centers in transition metal cluster compounds may interact with each other by means of delocalization of unpaired electron density from one metal site to another. This phenomenon, electron exchange, is more often called magnetic exchange because of the effect of delocalization on bulk magnetic properties. The interaction, arising in this work from superexchange through the diamagnetic orbitals of a bridging group, is ferromagnetic or antiferromagnetic. Ferromagnetism arises from the spin alignment of unpaired electrons which occupy orthogonal orbitals. Antiferromagnetism arises from spin pairing when unpaired electrons occupy the same orbital. In either case, for binuclear copper (II) systems the coupled spin states are split into a singlet state and a triple state with an energy separation of 2J.
Dissert. Abstr.

N79-25174 Princeton Univ., N. J.
RESONANCE CARS OF HEMES AND FLAVOPROTEINS Ph.D. Thesis
Prabir Kumar Dutta 1979 260 p
Avail: Univ. Microfilms Order No. 7910107

A new technique called Coherent Anti Stokes Raman Spectroscopy (CARS) that overcomes fluorescence problems allowing one to record Raman spectra of highly lumininscent systems was used to study resonance Raman spectra of hemes, flavins, and flavoproteins. The resonance CARS results of two clases of heme proteins were discussed. The main focus was on flavins. It was possible to discriminate against fluorescence and obtain good quality Raman spectra of flavins and their derivatives and flavoproteins. Spectra of model and flavodoxin semiquinone were obtained, thus giving a handle of distinguish various flavin redox forms. Charge transfer complexes of flavoproteins did not affect frequencies, but intensity effects were observed. Dissert. Abstr.

N79-25175 Houston Univ., Tex.
FORCED PERIODIC OSCILLATIONS IN CHEMICAL REACTORS: VAPOR-PHASE CONSECUTIVE-COMPETITIVE HYDROGENATION ON SUPPORTED METAL CATALYSTS Ph.D. Thesis
Maheyar Rustom Bilimoria 1978 183 p
Avail: Univ. Microfilms Order No. 7912824

Catalytic hydrogenation of acetylene to ethylene and ethane is a consecutive-competitive reaction with nonlinear kinetics and is an interesting candidate for selectivity modifications by intentional forced cyclic operation. This reaction was investigated in a practically isothermal, gradientless, continuous-flow spinning basket reactor under steady-state and transient conditions. Steady states were first evaluated over an entire range of hydrogen feed concentrations, and subsequent unsteady-state experiments involved periodic switching of hydrogen feed concentration between values at the high and low ends of this range. Selectivity modifications and improvement in both ethylene and ethane yields due to cycling were observed for several commercial nickel catalysts. It is shown that significant selectivity changes can be provided by forced-cyclic operation of a catalytic reactor.
Dissert. Abstr.

N79-25176 Minnesota Univ., Minneapolis.
STOCHASTIC MODELING OF CHEMICAL REACTORS Ph.D. Thesis
John Robert Ligon 1978 201 p
Avail: Univ. Microfilms Order No. 7912043

Stochastic models are developed to investigate the significance of fluctuating nature to fluidized beds on reactor performance. Fluctuating bubble size distributions are represented by random heat and mass transfer coefficients between the bubble and dense phases. The resulting models are nonlinear vector stochastic differential equations. A hybrid computer simulation technique is employed to determine the stationary statistical properties of the reactor state. Model predictions for various reactor parameters are studied as a function of the variance and fluctuation frequency of the stochastic transfer coefficients.
Dissert. Abstr.

N79-25177*# Wichita State Univ., Kans. Dept. of Aeronautical Engineering.
SUPERSONIC BURNING IN SEPARATED FLOW REGIONS Semiannual Status Report
Glen W. Zumwalt 15 May 1979 13 p
(Grant NsG-1575)
(NASA-CR-158707) Avail: NTIS HC A02/MF A01 CSCL 21B

Activities reported include: (1) the construction of a thermocouple with a protective coating or sheath for obtaining reliable temperature measurements of gases in the base region; (2) the construction of a multiposition back step plate for trough tests for step sizes 0.63 cm and 0.25 cm; and (3) flow pattern studies with the 6.35 cm trough to determine the complex flow resulting when a shear layer reattaches in a corner. Reliable ignition and stable burning were achieved at Mach = 2 for the 0.63 cm trough. Photographs of side wall oil streaks for M=2 flow, and some static and pitot pressure results at M = 3 are included.
A.R.H.

N79-25178*# Case Western Reserve Univ., Cleveland, Ohio.
X-RAY PHOTOELECTRON SPECTROSCOPY STUDY OF NICKEL AND NICKEL-BASE ALLOY SURFACE ALTERATIONS IN SIMULATED HOT CORROSION CONDITIONS WITH EMPHASIS ON EVENTUAL APPLICATION TO TURBINE BLADE CORROSION Final Report
Gheorghe D. Mateescu and Steven R. Smith Jun. 1979 49 p refs
(Grant NsG-3009)
(NASA-CR-159553) Avail: NTIS HC A03/MF A01 CSCL 07D

Research on the high temperature oxidation and Na2SO4 induced hot corrosion of some nickel base superalloys was accomplished by using ESCA to determine the surface composition of the oxidized or corroded samples. Oxidation was carried out

at 900 or 1000 C in slowly flowing O2 for samples of B-1900, NASA-TRW VIA, 713C, and IN-738. Oxidation times ranged from 0.5 to 100 hr. Hot corrosion of B-1900 was induced applying a coating of Na2SO4 to peroxidized samples, the heating to 900 C in slowly flowing O2. For oxidized samples, the predominant type of scale formed by each superalloy was determined, and a marked surface enrichment of Ti was found in each case. For corroded samples, the transfer of significant amounts of material from the oxide layer to the surface of the salt layer was observed to occur long before the onset of accelerating weight-gain. Changes in surface composition were observed to coincide with the beginning of accelerating corrosion, the most striking of which was a tenfold decrease in the sulfur to sodium ration and an increase in the Cr(VI) ratio. Author

N79-25179*# General Electric Co., Wilmington, Mass. Aircraft Equipment Div.

SOLID POLYMER ELECTROLYTE WATER ELECTROLYSIS PREPROTOTYPE SUBSYSTEM Final Report

6 Feb. 1979 188 p

(Contract NAS9-14205)

(NASA-CR-160234; JPR-152) Avail: NTIS HC A09/MF A01 CSCL 07D

Hardware and controls developed for an electrolysis demonstration unit for use with the life sciences payload program and in NASA's regenerative life support evaluation program are described. Components discussed include: the electrolysis module; power conditioner; phase separator-pump and hydrogen differential regulator; pressure regulation of O2, He, and N2; air-cooled heat exchanger; water accumulator; fluid flow sight gage assembly; catalytic O2/H2 sensor; gas flow sensors; low voltage power supply; 100 Amp DC contactor assembly; and the water purifier design. A.R.H.

N79-25180*# Lehigh Univ., Bethlehem, Pa. Center for Surface and Coatings Research.

DEVELOPMENT OF STABLE LOW-ELECTROOSMOTIC MOBILITY COATINGS Final Report

J. W. Vanderhoff and F. J. Micale May 1979 15 p refs

(Contract NAS8-32406)

(NASA-CR-161244) Avail: NTIS HC A02/MF A01 CSCL 07D

Long-time rinsings of the Z6040-methlycellulose coating used successfully on the ASTP MA=011 experiment indicate the permanency of this coating is inadequate for continuous flowing systems. Two approaches are described for developing coatings which are stable under continuous fluid movement and which exhibit finite and predictable electroosmotic mobility values while being effective on different types of surfaces, such as glass, plastics, and ceramic alumina, such as is currently used as the electrophoresis channel in the GE-SPAR-CPE apparatus. The surface charge modification of polystyrene latex, especially by protein absorption, to be used as model materials for ground-based electrophoresis experiments, and the preliminary work directed towards the seeded polymerization of large-particle-size monodisperse latexes in a microgravity environment are discussed. A.R.H.

N79-25181*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

IMPROVED, LOW COST INORGANIC-ORGANIC SEPARATORS FOR RECHARGEABLE SILVER-ZINC BATTERIES

Dean W. Sheibley Jun. 1979 27 p refs

(NASA-TP-1476; E-9930) Avail: NTIS HC A03/MF A01 CSCL 07D

Several flexible, low-cost inorganic-organic separators with performance characteristics and cycle life equal to, or better than, the Lewis Research Center Astropower separator were developed. These new separators can be made on continuous-production equipment at about one-fourth the cost of the Astropower separator produced the same way. In test cells, these new separators demonstrate cycle life improvement, acceptable operating characteristics, and uniform current density. The various separator formulas, test cell construction, and data analysis are described. A.R.H.

N79-25182# California Univ., Berkeley. Lawrence Berkeley Lab. National Resource for Computation in Chemistry.

REPORT ON THE WORKSHOP NUMERICAL ALGORITHMS IN CHEMISTRY: ALGEBRAIC METHODS

Cleve Moler, ed. and I. Shavitt, ed. 1978 166 p refs Workshop held at Santa Cruz, Calif., 9-11 Aug. 1978

(Contract W-7405-eng-48)

(LBL-8158; Conf-780878) Avail: NTIS HC A08/MF A01

Algebraic methods of numerical algorithms in relation to chemical applications were investigated. The three topics focused upon were: eigenvalue problems, linear systems of equations, and the four-index transformation of quantum chemistry. R.E.S.

N79-25183*# Yale Univ., New Haven, Conn. High Temperature Chemical Reaction Engineering Lab.

EXPERIMENTAL STUDIES OF THE FORMATION/DEPOSITION OF SODIUM SULFATE IN/FROM COMBUSTION GASES Semiannual Report, 16 Nov. 1977 - 15 May 1978

Daniel E. Rosner 15 May 1978 14 p refs

(Grant NsG-3169)

(NASA-CR-159612; SAR-1) Avail: NTIS HC A02/MF A01 CSCL 21B

Processes related to the hot corrosion of gas turbine components were examined in two separate investigations. Monochromatic laser light was used to probe condensation onset and condensate film growth (via interference of reflected light) on electrically heated ribbons immersed in seeded, flat flame combustion product gases. Boron trichloride is used as the seed gas in these preliminary experiments conducted to obtain precise measurements of the dew point/deposition rates. Because of the importance of gaseous Na(g) as a precursor to NaSO4 formation, the kinetics and mechanisms of the heterogeneous reaction H(g) + NaCl(s) yields Na(g) + HCl(g) was studied using atomic absorption spectroscopy combined with microwave discharge-vacuum flow reactor techniques at moderate temperatures. Preliminary results indicate the H-atom attack of solid NaCl vaporization is negligible; hence the corresponding gas phase (homogeneous) reaction no role in the observed Na(g) production. A.R.H.

N79-25184*# Yale Univ., New Haven, Conn. High Temperature Chemical Reaction Engineering Lab.

EXPERIMENTAL STUDIES OF THE FORMATION/DEPOSITION OF SODIUM SULFATE IN/FROM COMBUSTION GASES Semiannual Report, 16 May - 15 Nov. 1978

Daniel E. Rosner 15 Nov. 1978 16 p refs

(Grant NsG-3169)

(NASA-CR-159613; SAR-2) Avail: NTIS HC A02/MF A01 CSCL 21B

Interference in a reflected beam of monochromatic light from a linearly polarized helium-neon laser was used to determine the dew point and deposition rate of B2O3 on a heated platinum target. Preliminary results at different BCl3 seed levels, except for one flow velocity and equivalence ratio (.813) are presented and discussed. Alkali chloride reactions with atomic oxygen were also investigated. Readily detectable Na^*(g) and K^*(g) - atoms were observed in emission at 589 nm, 766nm, 796nm, respectively. A.R.H.

N79-25185# North Carolina Univ. at Chapel Hill. William R. Kenan Jr. Labs of Chemistry.

CHEMICALLY MODIFIED CARBON ELECTRODES. 17: METALLATION OF IMMOBILIZED TETRA AMINOPHENYL PORPHYRIN WITH MANGANESE, IRON, NICKEL, COPPER AND ZINC, AND ELECTROCHEMISTRY OF DIPROTONATED TETRAPHENYL PORPHYRIN

Roy D. Rocklin and Royce W. Murray 5 Mar. 1979 33 p refs

(Contract N00014-76-C-0817)

(AD-A066632; TR-9) Avail: NTIS HC A03/MF A01 CSCL 07/4

Tetra(aminophenyl)porphyrin can be amide-bonded to oxidized glassy carbon surfaces following activation with acetyl chloride or thionyl chloride, with the latter affording higher coverage. The immbolized porphyrin can be metallated with manganese, iron, colbalt, nickel, copper and zinc. The metalloporphyrins undergo electrochemical reactions in DMSO solvent at metal and ring-centered reduction potentials expected on the basis of solution molecular analogs. In the case of iron-metallated

porphyrin, electrochemistry can be done in aqueous acid, where a clear but porphyrin-debilitating dioxygen catalysis is observable. Author (GRA)

N79-25186# Washington Univ., Seattle. Lab. for Chemometrics.
IMAGE ANALYSIS Interim Report, Sep. 1978 - Mar. 1979
Mark G. Moran and Bruce R. Kowalski Mar. 1979 24 p refs
(Contract N00014-75-C-0536)
(AD-A066732; TR-14) Avail: NTIS HC A02/MF A01 CSCL 20/6

This article describes recent developments and applications in the field of chemistry that utilize the newly emerging engineering research methods of image analysis. The paper is tutorial in nature and was written at the request of the editorial board of the Journal of Analytical Chemistry. Author (GRA)

N79-25187# Colorado State Univ., Fort Collins. Dept. of Chemistry.
CHEMICAL AND ELECTROCHEMICAL STUDIES IN ROOM TEMPERATURE ALUMINUM HALIDE-CONTAINING MELTS
Helena L. Chum and R. A. Osteryoung Mar. 1979 41 p refs
(Contract N00014-77-C-0004)
(AD-A066800; TR-9) Avail: NTIS HC A03/MF A01 CSCL 07/2

This review of recent work in the area covers a brief overview of work in sodium tetrachloroaluminate melts, with emphasis on acid-base chemistry, species characterization, chemistry of chalcogenides and chalcogens and the stability of radical ions. Work in the aluminum chloride-n-butylpyridinium room temperature melt is covered in more detail with regard to species characterization by Raman spectroscopy, acid-base chemistry, the electrochemical and spectroscopic studies of aromatic hydrocarbons, and an indication of other studies of inorganic species in these melts. Author (GRA)

N79-25188# Aerospace Corp., El Segundo, Calif.
RATE COEFFICIENTS CALCULATED BY THE BOND-ENERGY BOND-ORDER METHOD FOR EXCITED STATE F AND H2 IN EQUILIBRIUM WITH H AND HF REACTIONS Interim Report
Stanley W. Mayer and Norman Cohen 16 Feb. 1979 25 p refs
(Contract F04701-78-C-0079)
(AD-A066484; TR-0079(4940-01)-2; SAMSO-TR-79-18) Avail: NTIS HC A02/MF A01 CSCL 07/4

Because of the importance of rate coefficients in determining the power output of HF and DF chemical lasers, the bond-energy bond-order (BEBO) method for predicting rate coefficients is applied herein to the excited-state reactions H2(v kcal) + F in equilibrium with H - HF(v = 0,1,2,3,...) and D2(v kcal) + F in equilibrium with D - DF(v = 0,1,2,3,...) where the value of v is 0,1,2,4,8,..., kcal of excitation. Inversions for these chemical laser reactions are predicted with this method inasmuch as the computed rate coefficients for the production of vibrationally excited HF and DF are higher than for ground-state HF and DF. Good agreement is obtained between computed and measured rate coefficients for the reaction of H2 and D2 with F atoms. The calculations also indicate that excitation of the H2 and D2 reactants can enhance the HF and DF inversions. An analysis is made to determine the molecular properties responsible for the larger rate coefficient for the formation of excited HF, and the vibrational frequencies are shown to be significant factors. The computations represent the first application of the BEBO method for calculating rate coefficients for the production of excited states. Author (GRA)

N79-25189# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
THE FRACTIONATION OF PGB SUB x BY MOLECULAR EXCLUSION CHROMATOGRAPHY
Herman W. Shmukler, Sara F. Kwong, Elaine Soffer, and Margaret G. Zawryt 21 Mar. 1979 15 p refs
(AD-A067327; NADC-79008-60) Avail: NTIS HC A02/MF A01 CSCL 07/3

Preparations of PGBx were separated into active and inactive fractions by molecular exclusion chromatography on Sephadex G-100 or G-150. The optimum pH for this separation was 7.2. Similar results were found with some other molecular exclusion type packings having equivalent porosity ranges. The molecular weight of the most active fraction was 1539. GRA

N79-25190# Hawaii Inst. of Geophysics, Honolulu.
RAW DATA AND FIRST ORDER CALCULATIONS FOR THE STUDY OF SILICA APPARENT SOLUBILITIES AND RATES OF DISSOLUTION AND PRECIPITATION FOR ca. 25 COMMON MINERALS AT 1-2 C, pH 7.5-8.5 IN SEAWATER
David C. Hurd Jan. 1979 49 p
(Contract N00014-75-C-0209)
(AD-A066915; HIG-79-1; HIG-DATA-35) Avail: NTIS HC A03/MF A01 CSCL 11/2

In these experiments approximately 25 common minerals were allowed to react with 1-2 C, pH 7.5-8.5 seawater having different dissolved silica concentrations, and the increase or decrease in dissolved silica was monitored with time. What makes these experiments unique is that they were done at low temperature (1-2 C) and that the solutions were periodically centrifuged and a new solution having the original dissolved silica concentration was re-introduced. In addition, specific surface areas of the minerals were determined before and after the experiment to monitor whatever changes might have occurred and to allow for these changes in the ensuing calculations. The report is divided into two sections; the first gives the raw data and preliminary calculations and the second gives elemental analyses of each mineral and references to analogous analyses by other workers. X-ray diffraction analyses were done on all samples, and listings of the positions of the major peaks are available upon request. GRA

N79-25191# National Physical Lab., Teddington (England).
A METHOD FOR ESTIMATING THE ENTHALPIES FOR FORMATION OF BENZENE DERIVATIVES IN THE GAS STATE
J. D. Cox Jun. 1978 20 p refs
(NPL-Chem-83) Avail: NTIS HC A02/MF A01

The estimation of enthalpies of formation for benzenoid compounds was studied. A simple equation model was tried with tri, tetra, and penta substituted benzenes ignoring positional isomerism. The simple model holds in 45 out of 78 examples of disubstituted benzenes within a difference of twice the experimental uncertainty. For trisubstituted benzenes it holds in 27 out of 42 examples; for tetra substituted benzenes, in 4 out of 17 examples; and for penta substituted examples it does not hold. Suggestions for improvement of the simple model are given. Author (ESA)

N79-25192# National Bureau of Standards, Washington, D. C. Center for Materials Science.
STANDARD REFERENCE MATERIALS: ELECTRON PARAMAGNETIC RESONANCE INTENSITY STANDARD: SRM 2501; DESCRIPTION AND USE
T. Chang and A. H. Kahn Aug. 1978 64 p refs
(PB-292097/3; NBS-SP-260-59; LC-78-600064) Avail: NTIS HC A04/MF A01 CSCL 07D

Information is presented concerning the use of ruby samples, of known Cr(+3) concentration, supplied as a Standard Reference Material (SRM) for intensity measurements in electron paramagnetic resonance (EPR) experiments. By comparing the measured intensities of EPR absorption lines of a test sample and of the SRM, it is often possible to obtain a determination of the number of spins in the test sample. Procedures and data on ruby necessary for carrying out this process as presented. Examples of the use of the SRM in typical cases are offered. GRA

N79-25074*# Boeing Aerospace Co., Seattle, Wash. Quality Assurance Labs.
ASSEMBLAGE ANALYSIS: IDENTIFICATION OF CONTAMINATION SOURCES
E. R. Crutcher *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 763-778 refs (For primary document see N79-25048 16-12)
Avail: NTIS HC A99/MF A01 CSCL 07D

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N79-25193 Tennessee Univ., Knoxville.
THE DIRECTIONAL SOLIDIFICATION OF THE CHROMIUM-TANTALUM CARBIDE AND THE CHROMIUM-NIOBIUM CARBIDE EUTECTICS BY THE LEVITATION ZONE MELTING METHOD Ph.D. Thesis
Ching-Chuan Yeh 1978 193 p
Avail: Univ. Microfilms Order No. 7911728

The microstructures of test melts of different composition of the eutectics of Cr-TaC, Cr-NbC, (Cr,Mo)pNcC and Cr-)Ta,Nb)C were examined by scanning electron microscopy and the different phases in the microstructures were determined from X-ray elemental analysis and X-ray diffraction patterns. The critical G/R ratios required for the alignment of these eutectics were estimated by a simple constitutional supercooling criterion. The heat transfer analysis of a simplified Bridgemen-Stockbarger furnace and a simplified levitation zone melter was carried out using a finite difference method. It was estimated that the thermal gradient obtained by using the levitation zone melting method is high enough to directionally solidify the Cr base eutectics at 1'/hr. The eutectics were not aligned during the first zone pass. Most of them were aligned during the second zone pass. Alignment times are given for the various systems. Dissert. Abstr.

N79-25194 British Library Lending Div., Boston Spa (England).
REVIEW OF THE METHODS OF REMOVING ELECTRICALLY DEPOSITED METAL COATINGS
May 1979 10 p Transl. into ENGLISH from Galvano Teknisk Tidsskrift (West Germany), v. 20, no. 4, 1977 p 19-21
(BLL-RTS-11851) Copyright. Avail: British Library Lending Div., Boston Spa, Engl.

The review in the previous edition by B. Zachariasson of the methods of removing electrically deposited metal coatings was unfortunately erroneously presented in respect of the groupings; the review is correctly presented. Author

N79-25195*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
METAL-DIELECTRIC INTERACTIONS
Donald H. Buckley 1979 24 p refs Presented at Conf. on Electrical Insulation and Dielectric Phenonena, Whitehaven, Pa., 21-25 Oct. 1979; sponsored by NRC
(NASA-TM-79151) Avail: NTIS HC A02/MF A01 CSCL 11F

Metal direlectric surface interactions and dielectric films on metal substrates were investigated. Since interfacial interaction depends so heavily on the nature of the surfaces, analytical surface tools such as Auger emission spectroscopy, X-ray photoelectron spectroscopy and field ion microscopy were used to assist in surface and interfacial characterization. The results indicate that with metals contacting certain glasses in the clean state interfacial, bonding produces fractures in the glasses while when a film such as water is present, fractures occur in the metal near the interface. Friction forces were used to measure the interfacial bond strengths. Studies with metals contacting polymers using field ion microscopy revealed that strong bonding forces could develop being between a metal and polymer surface with polymer transferring to the metal surface in various ways depending upon the forces applied to the surface in contact. With the deposition of refractory carbides, silicides and borides onto metal and alloy substrates the presence of oxides at the interface or active gases in the deposition plasma were shown to alter interfacial properties and chemistry. Auger ion depth profile analysis indicated the chemical composition at the interface and this could be related to the mechanical, friction, and wear behavior of the coating. R.E.S.

N79-25196*# Pittsburgh Univ., Pa. Dept. of Metallurgical and Materials Engineering.
AN INVESTIGATION OF THE INITIATION STAGE OF HOT CORROSION IN Ni-BASE ALLOYS Progress Report
T. T. Huang and G. H. Meier 31 Mar. 1979 44 p refs
(Grant NsG-3214)
(NASA-CR-159616) Avail: NTIS HC A03/MF A01 CSCL 11F

The mechanisms which lead to the destruction of a normally protective scale during the initial stages of hot corrosion of 14 nickel-base alloys contaminated with Na2SO4 and other condensed deposits were investigated. A continuous reading microbalance was used to record weight changes at temperatures between 900 C and 1000 C at 1 atmosphere pressure of slowly flowing oxygen. The reaction was initiated by raising a preheated furnace around the quartz tube in which the specimen was supported with oxygen flowing. The furnace was raised in a time period of seconds. At 900 C, the system and specimen came to thermal equilibrium in less than one minute. Oxidized specimens were studied using optical and scanning electron metallography and X-ray diffraction techniques. Transmission electron microscopy and electron diffraction spectroscopy were also used to identify the structure of carbides in some of the commercial alloys. A.R.H.

N79-25197*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
HEAT TREAT FIXTURE Patent Application
Charles S. Beuyukian (Rockwell International, Downey, Calif.) and Robert M. Heisman, inventors (to NASA) (Rockwell International, Downey, Calif.) Filed 23 Mar. 1979 11 p Sponsored by NASA
(NASA-Case-LAR-11821-1; US-Patent-Appl-SN-023501) Avail: NTIS HC A02/MF A01 CSCL 11F

A heat treating fixture is disclosed in which the shape of the metal specimen is maintained by cold rolled steel support plates. Glide sheets of stainless steel, coated with boron nitride, in contact with each face of the metal specimens, allow for lateral expansion of the metal specimens without binding. Grooved support bars separate the glide sheets from the upper and lower support plates and allow flow of quenching fluid to the metal specimen. NASA

N79-25198# Florida Univ., Gainesville. Dept. of Materials Science and Engineering.
RESEARCH ON INHIBITION FOR CORROSION FATIGUE OF HIGH STRENGTH ALLOYS Final Report, 15 May 1975 - 2 Oct. 1978
Ellis D. Verink, Jr. and K. Bhagwan Das (Boeing Aerospace Co., Seattle, Wash.) 15 Dec. 1978 102 p refs
(Contract F33615-75-C-5200)
(AD-A067335; AFML-TR-78-178) Avail: NTIS HC A06/MF A01 CSCL 11/6

Over 200 potential inhibitor compositions were screened in selecting three final candidates to test in determining the effectiveness of oxidizing inhibitors in controlling hydrogen embrittlement of aerospace structural materials. Alloys tested included 4340, 300M, 17-4 PH, HP 9-4-30 and HY180. The three final inhibitors were the 'blocking type' inhibitors, piperidine, and piperazine and a proprietary, polyfunctional inhibitor Nalco 39L. When present in sufficient concentration (1 M), the blocking inhibitors reduced hydrogen content at (or near) the fracture surface significantly, reduced the crack growth rate several orders of magnitude and increased K sub Iscc to approximately K sub Ic under static conditions. The polyfunctional inhibitor reduced measured hydrogen content to the lowest levels (of the three inhibitors), however, only the manufacturer's recommended concentration was generally effective. At lower as well as higher concentrations crack growth rates increased. At low concentrations, the fracture character resembled hydrogen embrittlement whereas at higher concentrations active path cracking was observed. Suggestions are made for future research.
Author (GRA)

N79-25199# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Chemistry.
PASSIVATION STUDIES OF IRON, NICKEL AND THEIR ALLOYS BY 'IN SITU' ELLIPSOMETRY AND 'EX SITU' ESCA TECHNIQUES Ph.D. Thesis
C. T. Chen, B. D. Cahan, and E. Yeager 15 Feb. 1979 225 p refs
(Contract N00014-75-C-0953; NR Proj. 359-451)
(AD-A067364; TR-48) Avail: NTIS HC A10/MF A01 CSCL 11/6

The passivation film on iron has been examined in situ using automatic ellipsometry to obtain the spectral properties. Both structural and mechanistic information has been obtained concerning this film. This represents the first time such spectroscopic information is available. ESCA has been used as a ex situ complementary tool to examine iron and also nickel and their alloys. Author (GRA)

N79-25200# Lockheed Missiles and Space Co., Palo Alto, Calif.
DEVELOPMENT OF ADVANCED ALUMINUM ALLOYS FROM RAPIDLY SOLIDIFIED POWDERS FOR AEROSPACE STRUCTURAL APPLICATIONS Interim Technical Report, 5 Sep. 1978 - 4 Mar. 1979
R. E. Lewis Mar. 1979 125 p
(Contract F33615-78-C-5203; ARPA Order 3575)
(AD-A067270; LMSC-D674504) Avail: NTIS HC A06/MF A01 CSCL 11/6

Advanced aluminum alloys are being developed that will provide major payoffs in terms of weight savings for new aerospace structures. The two property goals are: (1) a 30-percent increase in modulus of elasticity-to-density ratio, and (2) a 20-percent increase in modulus of elasticity-to-density ratio plus a 20-percent increase in strength-to-density ratio, when compared to Al 7075-T76 and without a significant loss in other properties important for structural applications. GRA

N79-25201# General Electric Co., Philadelphia, Pa. Re-Entry and Environmental Systems Div.
TITANIUM COMBUSTION STUDY Final Report, 7 Sep. 1976 - Nov. 1977
R. J. Sullivan 8 Dec. 1977 33 p refs
(Contract DNA001-76-C-0372)
(AD-A066813; AD-E300475; DNA-4633F; Doc-78SDR2217) Avail: NTIS HC A03/MF A01 CSCL 16/3

A heated titanium structure flying through a nuclear burst dust cloud may experience aerodynamic heating, kinetic energy heating and oxidation. The rate of heat transfer due to oxidation is examined to determine its contribution relative to other mechanisms of heat transfer, and whether an increase in oxidation heat transfer occurs in the presence of water vapor. The results of the investigation show that heat transfer is dominated by particle kinetic energy conversion and aerodynamic heating to a roughened surface. Oxidation heat transfer is negligible at temperatures of interest to the structure. Author (GRA)

N79-25202# Army Materials and Mechanics Research Center, Watertown, Mass.
FRACTURE TOUGHNESS AND STRESS CORROSION CHARACTERISTICS OF ULTRAHIGH-STRENGTH 4340 STEEL, SUMMARY REVIEW Final Report
Anthony K. Wong, Milton Levy, and Walter F. Czyrklis Feb. 1979 22 p refs
(DA Proj. 1X4-64621-D-073)
(AD-A066814; AMMRC-MS-79-1) Avail: NTIS HC A02/MF A01 CSCL 11/6

A review was made of the fracture toughness (K sub Ic) and stress corrosion (K sub Iscc) characteristics of 4340 steel within the 200 to 250 ksi yield strength range. This literature review was conducted in support of a fracture mechanics and environmental investigation of 4340 steel for the control section housing of the Copperhead CLGP (Cannon-Launched Guided Projectile) weapon system. Factors affecting toughness and corrosion cracking characteristics are considered. Also included are data pertaining to the damaging effects of humidity. Fracture toughness and stress corrosion cracking resistance of 4340 steel are usually higher in the alloys possessing lower yield strengths. Author (GRA)

N79-25203# Georgia Inst. of Tech., Atlanta. Fracture and Fatigue Research Lab.
THE EFFECT OF ION PLATING AND ION INPLANTATION ON THE CYCLIC RESPONSES AND FATIGUE CRACK INITIATION OF METALS AND ALLOYS Technical Report, 1 Mar. 1978 - 28 Feb. 1979
S. Spooner, H. Solnick-Legg, and E. A. Starke, Jr. Mar. 1979 30 p refs
(Contract N00014-78-C-0270)
(AD-A066547; TR-1) Avail: NTIS HC A03/MF A01 CSCL 11/6

X-ray diffuse scattering and transmission electron microscopy have been used to study the defect state of copper implanted with aluminum and argon ions. Electron microscopy studies of argon implanted thin foils reveals vacancy loops in the size range of 70A to 350A diameter for a dose of 2 x 10 to the 15th power ions/sq. cm. at 100 kev. X-ray diffuse scattering measured around the 222 Bragg reflection reveals a combination of microalloying and dislocation loop effects from implantation of aluminum ions to a dose of 2 x 10 to the 16th power ions/sq. cm. at 100 kev. Loop densities on the order of 10 to the 17th power/sq. cm. and an average loop size of 25A was estimated from the X-ray data. The aluminum ion damage is largely unchanged upon annealing for 30 minutes at 500 and 600 C. Alloying appears to stablize the surface radiation damage relative to damage produced in self-ion bombardments. The possible effectiveness of implanted layers in affecting fatigue crack initiation is being assessed. Author (GRA)

N79-25204# Indiana Univ. at Bloomington. Dept. of Chemistry.
THE TUNGSTEN-TUNGSTEN, TRIPLE BOND. 8(1) DINUCLEAR ALKOXIDES OF TUNGSTEN (3) STRUCTURAL CHARACTERIZATION OF HEXAKIS (ISOPROPOXY) DIPYRIDINODITUNGSTEN. THE FIRST COMPOUND WITH FOUR-COORDINATED TUNGSTEN ATOMS UNITED BY A TRIPLE BOND
M. Akiyama, M. H. Chisholm, F. A. Cotton, M. W. Extine, and D. A. Haitko 20 Mar. 1979 34 p refs Submitted for publication
(Contract N00014-76-C-0826)
(AD-A066799; TR-2) Avail: NTIS HC A03/MF A01 CSCL 07/2

The great majority of compounds containing metal-metal triple bonds of the x3mmx3 type where X is a monodentate ligand (including some where the ligand atoms are not all the same) have perfectly, or almost perfectly, staggered ethane-like rotational conformations. The great majority of compounds containing metal-metal quadruple bonds are of the type X4MMX4 (again including those where more than one type of ligand is present) and have essentially eclipsed rotational conformations. The relatively few exceptions to each of these generalizations are of interest because they provide further insight into the nature of metal-metal multiple bonds. GRA

N79-25205# Naval Postgraduate School, Monterey, Calif.
LASER INDUCED EVAPORATION FROM STAINLESS STEEL SURFACES M.S. Thesis
Zen Wen Hwang Dec. 1978 101 p refs
(AD-A066495) Avail: NTIS HC A06/MF A01 CSCL 20/5

Laser-induced evaporation from a stainless steel surface was the laser-target damage mechanism which was studied. Infrared laser pulses with irradiances higher than 10 to the 9th power W/sq cm were produced by a Q-switched neodymium glass laser. Experiments were performed in a vacuum chamber evacuated to about 10 to the 9th power W/sq cm Torr. The mass of evaporated material, area of laser-drilled hole and depth of damaged hole were measured. Results showed that the mass of evaporated material was proportional to sq rt F where F is the laser flux in W/sq cm. Surface damage phenomena were studied by metallographic methods using an optical microspace and scanning electron microscope (SEM). Evaporated materials were partially collected and analyzed separately with the SEM and Princeton Gamma Tech (PGT) 1000 X-ray analyzer. GRA

N79-25206# Brown Univ., Providence, R. I. Div. of Engineering.
STRAIN RATE AND STRAIN RATE HISTORY EFFECTS IN TWO MILD STEELS
M. L. Wilson, R. H. Hawley, and J. Duffy Mar. 1979 24 p refs
(Grants DAAG29-77-G-0038; NSG ENG-75-18532)
(AD-A067204; ARO-14363.2-E) Avail: NTIS HC A02/MF A01 CSCL 11/6

Results are presented of a series of experiments performed with two steels to investigate the dependence of flow stress on strain rate and its history. For this purpose quasi-static, dynamic and incremental strain rate tests were conducted on SAE 1020

hot-rolled steel and SAE 1018 cold-rolled steel at room temperature. It is shown that while the flow stress of both steels exhibits a significant strain rate sensitivity, the effect of strain rate history is relatively small in comparison with that generally found in fcc and hcp metals. A comparison is made with results of the work of other investigators. Author (GRA)

N79-25207# International Nickel Co., Inc., Suffern, N. Y. Inco Research and Development Center.

PRODUCTION AND EVALUATION OF REFe2-NICKEL COMPOSITE MAGNETOSTRICTIVE MATERIALS Final Report

D. T. Peters Jan. 1979 40 p refs

(Contract N00039-77-C-0108)

(AD-A066947) Avail: NTIS HC A03/MF A01 CSCL 11/6

The objective was to produce a composite magnetostrictive material consisting of particles of the 'giant' magnetostrictive material, SmFe2, distributed within a pure nickel matrix, and to demonstrate a marked enhancement of the magnetostrictive properties of this composite compared to the properties of nickel. GRA

N79-25208# Laboratorio per la Tecnologia dei Materiali Metallici non Tradizionali, Milan (Italy).

HOTSALT STRESS CORROSION CRACKING OF ALLOYS: Ti-5A-2.5Sn; Ti-6A-4V; Ti-8Al-1Mo-1V; Ti-13V-11Cr-3Al European Concerted Action. COST 50 - Materials for Gas Turbines, Project I-3. Final Report

G. Taccani and B. Vicentini Jun. 1977 34 p refs Submitted for publication

(LTM-R-77/5) Avail: NTIS HC A03/MF A01

The hot salt stress corrosion cracking of certain titanium alloys was investigated both by means of exposure experiments with U-bent specimens and by means of electrochemical experiments with a macrocouple model. With this model it was possible to both confirm the electrochemical mechanism with which this form of corrosion is produced and to perfect a system capable of revealing the incubation period of cracks in function of environmental, metallurgical, and mechanical factors with good reproducibility and the necessary accuracy. Author (ESA)

N79-25209# Laboratorio per la Tecnologia dei Materiali Metallici non Tradizionali, Milan (Italy).

HIGH TEMPERATURE LOW-CYCLE FATIGUE BEHAVIOR OF NICKEL-BASE SUPERALLOYS. INFLUENCE OF TESTING FREQUENCY AND STRESS OR STRAIN WAVE FORM European Concerted Action. COST 50 - Materials for Gas Turbines, Project I-2. Final Report

L. Massarelli and M. Marchionni Oct. 1977 34 p refs Original contains color illustrations

(LTM-R-77/9) Avail: NTIS HC A03/MF A01

Fatigue behavior of a nickel base alloy, type IN 738 LC, was investigated by means of tension/compression and rotating bending tests carried out in air at 850 C. The influence of test frequency and stress or strain wave form on fatigue test results was analyzed. The work concentrated on studying the effects of stress or strain rate (and therefore of frequency) on both diametral strain controlled and load controlled tests. Fatigue test results show that the strain rate has a pronounced influence with greater endurances obtained at the higher strain rates. This appears to depend on the different distribution of the elastic and plastic components of the total applied strain, so much so that, at the higher strain rate, a greater elastic strain occurred. Author (ESA)

N79-25210# Fiat Research Center, Turin, Italy. Unita di Ricerca Technologie Metallurgiche.

INVESTIGATION ON THE EFFECT OF YTTRIUM AND CERIUM ADDITIONS ON THE CORROSION RESISTANCE OF SLURRY CHROMIUM ALUMINIZED IN 738 LC SUPERALLOY European Concerted Action. COST 50 - Materials for Gas Turbines, Project 16. Final Report

P. C. Martinengo and C. Carughi 1978 43 p refs

Avail: NTIS HC A03/MF A01

The production and investigation of high temperature behavior of yttrium and cerium chromium aluminum diffusion coatings on IN 738 LC and Hastelloy X superalloys are discussed. The coating elements used were chromium, aluminum, and rare earth hydrides suitably prepared and deposited on the base materials by means of a slurry process followed by diffusion treatments. The influence of yttrium and cerium additions on the properties of CrAl coatings is pointed out. The corrosion protection, thermal properties, and creep resistance of the coatings were investigated; rig test analyses were performed with Fiat equipment. Yttrium modified coatings show better high temperature behavior. Author (ESA)

N79-25211# Fiat Research Center, Turin, Italy. Unita di Recerca Tecnologie Metallurgiche.

INVESTIGATION ON THE EFFECT OF POROSITY, MICROSTRUCTURE AND IMPURITY ON THE CORROSION RESISTANCE OF MoSi2 COATINGS OBTAINED BY DIFFERENT PROCESSES ON NIMONIC 90 SUPERALLOY European Concerted Action. COST 50 - Materials for Gas Turbines, Project 17. Final Report

P. C. Martinengo and C. Carughi 1978 34 p refs

Avail: NTIS HC A03/MF A01

Coatings of MoSi2 on Nimonic 90 were prepared through siliconizing of molybdenum coatings obtained with plasma spray or ion plating processes. Their high temperature behavior was evaluated by means of thermal shock, oxidation, and corrosion tests. It is shown that microstructure and processing parameters of the initial molybdenum layer largely effect the MoSi2 coating properties. Porosity control in the Mo layer and suitable interlayers between MoSi2 and Nimonic 90 are necessary to obtain positive results. Plasma spray makes it possible to obtain better MoSi2 coating properties: Ni and B additions are beneficial in view of their oxidation resistance. Author (ESA)

N79-25212# Staal-Laval Turbin AB, Finspaang (Sweden).

THE INFLUENCE OF MICROSTRUCTURE, IN PARTICULAR GRAIN SIZE, ON THE LOW CYCLE FATIGUE BEHAVIOR AT SERVICE TEMPERATURE OF THE SUPERALLOYS X40, UDIMET 500, IN 738 LC AND INCONEL 939 European Concerted Action. COST 50 - Materials for Gas Turbines, Project S-1

Ragnar Ekbom, Jan Viklund, and Haakan Johansson 21 Nov. 1977 44 p Sponsored by Swed. Board for Tech. Develop. Prepared jointly with Swed. Inst. for Metal Res., Stockholm

Avail: NTIS HC A03/MF A01

In precision cast turbine blades the microstructure can show a wide variation between different castings. To investigate the effect of the microstructure on fatigue properties, crack propagation and low cycle fatigue (LCF) tests on Udimet 500, Inconel 738 LC, X 40, and Inconel 939 were performed on material with large and small grain sizes. In the LCF tests, the large grain size gives superior properties in material Inconel 739 and X 40, while LCF properties in material Udimet 500 and Inconel 738 LC appear to be insensitive to grain size. In crack propagation tests, there is no significant difference in propagation rate between the different grain sizes. The reason for the difference in the LCF properties may not be the grain sizes but other structural variables. For X 40 the morphology of the carbide phase might be the most important factor. In Inconel 739 there is a greater probability for interdendritic fracture in the small grain size material and this may be the reason for the difference in the LCF properties. Author (ESA)

N79-25213# Liverpool Univ. (England). Dept. of Metallurgy and Materials Science.

THE EFFECT OF ALLOY COMPONENTS ON THE HOT CORROSION BEHAVIOR OF NICKEL-BASE ALLOYS European Concerted Action. COST 50 - Materials for Gas Turbines, Project UK-2. Final Report

D. P. Whittle and J. Stringer Dec. 1977 29 p refs Sponsored by Sci. Res. Council

Avail: NTIS HC A03/MF A01

The hot corrosion behavior of a number of commercially available alloys was studied in detail. A range of simpler, model alloys generic to the complex superalloys was also included. A salt-condensation (DEAN) test was used in which salt is evaporated into a gas stream from a reservoir and allowed to condense on the samples which are held at a temperature lower than the salt reservoir. Salt-coating tests, in which samples are coated with approximately 1 mg/sq cm of sulfate prior to

oxidation, were also carried out. The incubation period is not very dependent on the detailed alloy chemistry, but only on whether the alloy developes a Cr203 or Al203 scale; thus the Cr/Al ratio is important. Breakdown of Al203 scales is generally catastrophic. Alloys protected by Cr203 scales can usually accommodate considerable sulfidation without catastrophic attack. Molybdenum in the alloys plays a crucial role in promoting accelerated attack, but not necessarily in initiating it. Other refractory elements have a similar, though less marked effect.
Author (ESA)

N79-25214# Central Electricity Research Labs., Leatherhead (England).
ELECTROCHEMICAL STUDIES OF THE CORROSION IN ALLOYS OF GAS TURBINES European Concerted Action. COST 50 - Materials for Gas Turbines, Project UK-6. Final Report
A. J. Cutler and C. J. Grant Mar. 1978 89 p refs
Avail: NTIS HC A05/MF A01

Electrochemical measurement and metalographic examination were used in long term (2000 hr) corrosion tests for 21 commercial nickel and cobalt base superalloys. Tests were made at 1100 and 1200 K in molten alkaline sulfate. Corrosion behavior is shown to be directly related to the concentration of Cr in the alloys. A major improvement in the resistance to accelerated corrosion is shown by the Ni alloys with Cr concentrations greater than 15 w/o. Cobalt alloys, all containing more than 20 w/o of Cr, did not corrode in the accelerated tests, although they tend to show a deeper sulfide penetration. Corrosion mechanisms are discussed. Author (ESA)

N79-25215# Centre de Recherches Metallurgiques, Liege (Belgium).
DIRECTIONAL SOLIDIFICATION OF SUPERALLOYS European Concerted Action. COST 50 - Materials for Gas Turbines, Project B-9/1. Final Report
M. Lamberigts, P. Viatour, J. M. Drapier, and D. Coutsouradis Jun. 1978 92 p refs Sponsored by Inst. pour l'Encouragement de la Rech. Sci. dans l'Ind. et l'Agr.
Avail: NTIS HC A05/MF A01

The properties of conventional cobalt-base superalloys, whose oriented structures had been obtained through a local remelting procedure carried out on either vacuum or air cast rods, were more thoroughly determined. These materials were compared with their equiaxed counterparts and the vacuum-cast equiaxed alloy Mar-M-509. An attempt was made to experimentally define, through the study of several alloys based on the Co-Cr-C-W system with modified solution and/or precipitation strengthing, a material whose composition would be adapted to the directional solidification process in such a way as to achieve higher stress-rupture strength than conventional Mar-M-509. To obtain oriented structures in nickel-base superalloy as-cast rotor blades, the equipment was modified to allow prior remelting of the alloy and casting in a preheated shell mold, thus providing the thermal conditions necessary to the development of a columnar structure. Structural characteristics were evaluated, but with unsatisfactory results due to insufficient thermal shock resistance of the blade material. Author (ESA)

N79-25216# Centre de Recherches Metallurgiques, Liege (Belgium).
HIGH STRENGTH COBALT-BASE ALLOYS DEVELOPED BY POWDER METALLURGY TECHNIQUES European Concerted Action. COST 50 - Materials for Gas Turbines, Project B 11/1. Final Report
P. Viatour, P. Guillaume, J. M. Drapier, D. Coutsouradis, and L. Habraken Jun. 1978 24 p refs Sponsored by Inst. pour l'Encouragement de la Rech. Sci. dans l'Ind. et l'Agr.
Avail: NTIS HC A02/MF A01

The capabilities of experimental Co-base alloys adapted to powder metallurgy techniques are discussed. Several strengthening mechanisms (solid solution strengthening, carbides and/or intermetallic compounds precipitation) were tried to achieve high strength levels at intermediate temperatures. The relations between microstructures and mechanical properties were investigated. Carbide strengthening of Co-10 to 15%Ni-20%Cr-10%Mo powder metallurgy alloys gives rise to a moderate tensile strength. Ultimate tensile strengths of about 1,350 MN/sq m at 650 C were achieved in the fine-grained Co-16%Cr-3%Mo-5%Ti powder metallurgy alloy with the corresponding ductilities limited to 4%. The ductility is markedly higher for the coarse-grained material. However, the corresponding tensile strength is limited to 1,400 MN/sq m at room temperature and to 1,000 MN/sq m at 650 C, but can be improved through a final aging treatment. Author (ESA)

N79-25217# Swedish Inst. for Metal Research, Stockholm.
METHODS FOR MODIFYING THE AS-CAST STRUCTURE, IN PARTICULAR THE GRAIN SIZE DURING PRECISION CASTING OF THE SUPERALLOYS X 40, UDIMET 500 AND IN 738 L. C. European Concerted Action. COST 50 - Materials for Gas Turbines, Project S-4. Final Report
L. Baeckerud, B. Callmer, B. Carlsson, K-B. Johansson, and A. Westerlund Aug. 1978 59 p refs Sponsored by Swed. Board for Tech. Develop. Prepared jointly with Bulten-Kanthal, Hallstahammar, Swed.
Avail: NTIS HC A04/MF A01

The influence of composition, thermal conditions, and casting techniques was studied in reference to the nucleation and crystal growth of superalloys. Several commercially available alloys and some synthetic alloys were used. Thermal, chemical, and X-ray analysis were done as well as a metalographic examination to study the solidification process. In particular, the addition of hafnium and boron to IN 738 LC was studied. Several detailed results are discussed. Author (ESA)

N79-25218# National Physical Lab., Teddington (England). Div. of Chemical Standards.
THE DETERMINATION OF THE ALLOYING CONSTITUENTS OF MILD, LOW ALLOY, AND STAINLESS STEELS BY X-RAY EMISSION SPECTROSCOPY
Joyce M. Griffiths and H. R. Whitehead May 1978 24 p refs (NPL-Chem-85) Avail: NTIS HC A02/MF A01

A simple empirical inter-element correction procedure was applied to the analysis of steels of widely varying composition. A number of test steels were analyzed and the results are discussed. Author (ESA)

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N79-25219 Connecticut Univ., Storrs.
THE DETERMINATION OF MOLECULAR DIMENSIONS OF POLYMERS AS A FUNCTION OF CONCENTRATION BY DIFFERENTIAL GEL PERMEATION CHROMOTOGRAPHY Ph.D. Thesis
Edward Gerald Bartick 1978 135 p
Avail: Univ. Microfilms Order No. 7912996

Differential gel permeation chromatography was used to develop a method to quantitatively measure the hydrodynamic dimensions of polymers at various concentration levels. Linear polystyrene samples were measured in tetrahydrofuran as a solvent. The dimensions of the hydrodynamic volume and radius were measured as a function of concentration under several conditions. Narrow molecular weight (MW) samples were measured in a medium of polydisperse MW polystyrene as well as in a medium of narrowly disperse MW polystyrene. Comparisons in the change of the dimensions were made between samples different in MW from that of the resident polymer establishing the medium. Comparisons were also made between different MW samples each having the same molecular weight species as the resident polymer. The resident polymer medium established the mobile phase of the chromatograph. Dissert. Abstr.

N79-25220 Massachusetts Univ., Amherst.
CRYSTALLIZATION-INDUCED REACTIONS OF LIQUID-CRSTALLINE COPOLYESTERS Ph.D. Thesis
Kurt Alan Feichtinger 1979 272 p
Avail: Univ. Microfilms Order No. 7912679

The crystalline and liquid crystalline properties of thermotropic aromatic copolyesters of the substituted para oxybenzoate

units and ethylene terephthalate unit were investigated. The effect of various solid state reaction parameters on the overall reorganization rate for crystallization induced reaction treatment was studied to elucidate a rate controlling mechanism. Conflicting results were observed regarding the rate controlling mechanism of reorganization. The result of the determination of temperature and annealing effects was the conclusion that crystallization was rate controlling. The catalyst concentration and endgroup content experiments indicated ester interchange was the rate controlling mechanism. A model was proposed in which ester interchange reactions could create para oxybenzoate sequences of sufficient length to nucleate the growth of a crystalline domain.
Dissert. Abstr.

N79-25221 Illinois Univ. at Urbana-Champaign.
THE CONFIGURATIONAL STATISTICS OF CONFINED POLYMER CHAINS Ph.D. Thesis
David John Lohse 1978 221 p
Avail: Univ. Microfilms Order No. 7913533

Two methods for determining the general statistics of a confined chain were discussed. The first was the method of images. The second method involved the use of differential equations. Next a specific case was considered. The statistics of the unconfined chain were chosen to be defined by the Gaussian real chain distribution. These statistics were then applied to two polymer systems in which the confinement was due to internal surfaces, semicrystalline polymers and block copolymers. Two effects were found which determine the behavior of the chains in these systems. The first was the effect of the confinement which operated on all the chains, since the mode of attachment was not important. The second effect operated only on bridges, since it required that the ends of the chain be attached to different walls. Dissert. Abstr.

N79-25222 Connecticut Univ., Storrs.
MOLECULAR CHARACTERIZATION OF POLYOLEFINS USED FOR ELECTRICAL INSULATION Ph.D. Thesis
John Albert Crowther, Jr. 1978 194 p
Avail: Univ. Microfilms Order No. 7911353

A high temperature gel permeation chromatograph was designed, constructed, and evaluated for use in polyolefin analyses. The chromatography incorporates several modifications including a small recording balance to accurately measure the elution weight (or volume). The balance was tested and results are discussed with respect to linearity, accuracy, and reproducibility. The chromatograph has been evaluated extensively and results discussed including calibration procedures for polystyrene, polyethylene, and polypropylene. The effect of thermal and electrical stresses on polymeric electrical insulating materials were investigated. Molecular weight distribution studies of polyethylene subjected to thermal stressing both above and below the melting point, and room temperature studies on the effect of electrical stresses on molecular weight distribution were conducted to aid in predicting accurate lifetime estimates for electrical insulating materials. The applicability of Arrhenius type extrapolations to predict degradation rates from accelerated tests is also reported. Dissert. Abstr.

N79-25223 Case Western Reserve Univ., Cleveland, Ohio.
MORPHOLOGY, STRUCTURE AND DEFORMATION OF POLYMER CRYSTALS Ph.D. Thesis
Hirokazu Hasegawa 1979 228 p
Avail: Univ. Microfilms Order No. 7909354

The morphology of nylon 6 crystallized from solution is discussed based on electron diffraction and optical and electron microscopy. A number of different morphologies were obtained: spherulites, sheaf-like crystals, single crystals, globular particles, fibrils and thin films. A given suspension of nylon 6 contains several to all of these morphologies. The composition and fine structure of the precipitate change with crystallization conditions as well as conditions of solvent evaporation. Different morphologies have different crystal structures. The crystal structure also changes with crystallization temperature, shelf-aging and annealing. The force-elongation curve obtained for an isolated polymer single crystal with the aid of the Nanothensilometer was characterized. In addition to the elastic modulus of the lamella, the energy of fibril formation and the elastic modulus of the fibrils pulled out across the gap were obtained. The results suggest a mechanism of fibril formation in which a bundle of chains is split from the lamella maintaining the chain-folded structure. Dissert. Abstr.

N79-25224 North Carolina State Univ. at Raleigh.
THE EFFECTS OF PRESSURE ON THE COMPRESSIBILITY AND CRYSTALLIZATION OF LINEAR POLYMERS Ph.D. Thesis
Kei-Yi Wei 1978 86 p
Avail: Univ. Microfilms Order No. 7905512

The effects of pressure on the compressiblity and crystallization of four fiber-forming polymers: poly(ethylene terephthalate), poly(tetramethylene terephthalate), Nylon 66, and Qiana were investigated. The approach taken was to adapt the capillary Rheometer as a high pressure dilatometer to perform all the high pressure experiments. In the first study, the solid and melt state compressibilities of these polymers were measured. The studies of compressibility reaffirmed that polymers are highly compressible, and their compressibilities are nonlinear at temperatures above their glass transition temperature. In the second study, the kinetics of crystallization of poly(ethylene terephthalate), poly(tetramethylene terephtalate), Nylon 66 and Qiana Nylon melts under high pressures were studied. In the third study, by slowly cooling these polymer melts under high pressures, crystallization temperatures of the polymers were measured. Dissert. Abstr.

N79-25225 Cornell Univ., Ithaca, N. Y.
A MICROSCOPICAL AND MECHANICAL STUDY OF THE STUDY OF THE GELATIN OF COLLAGEN CROSSLINKED WITH GLUTARALDEHYDE Ph.D. Thesis
Richard Clifford Weissman 1979 398 p
Avail: Univ. Microfilms Order No. 7910840

Reconstituted solubilized collagen has potential uses as a biomedical material. The gelation of dilute aqueous solutions of enzyme treated, telopeptide poor, collagen crosslinked with glutaraldehyde is examined. The effect that changes in collagen concentration, glutaraldehyde concentration, and pH in the acid range have on the gels was investigated. The kinetics of the gelling reaction were monitored mechanically by means of a freely damped, air lubricated torsion pendulum. The crosslinks are considered to be the products of the reaction. The morphology of the gels was studied by transmissions electron microscopy. This procedure permitted the preservation and examination of structure at various stages of crosslinking. Some of the gels were also prepared by embedding and thin sectioning.
Dissert. Abstr.

N79-25226 Minnesota Univ., Minneapolis.
WATER BINDING PROPERTIES OF MACROMOLECULAR SYSTEMS Ph.D. Thesis
Grant Curtis Busk 1978 251 p
Avail: Univ. Microfilms Order No. 7911982

A multi-dimensional approach was used to explore the interactions between water and polymers in solution. The specific techniques used included: (1) evaluation of suction pressure created by capillaries; (2) the effect of magnetic pulses on proton spin by NMR; (3) vapor pressure depression effects as measured by the vapor pressure manometer; (4) water binding effects at low water contents as measured by both adsorption and desorption isotherms; (5) the viscous nature of the gel as measured by resistance to shear through the gel; and (6) the rate of diffusion of a large molecule in gel systems. Dissert. Abstr.

N79-25227 Massachusetts Univ., Amherst.
DYNAMIC MECHANICAL PROPERTY STUDIES OF SEGMENTED POLYURETHANES AND EPOXY RESINS Ph.D. Thesis
George Albert Senich, Jr. 1979 291 p
Avail: Univ. Microfilms Order No. 7912715

An apparent irreversible relaxation process above the glass transition temperature in dynamic spring analysis determinations was attributable to solvent evaporation from incompletely dried films. Studies on carefully prepared polystyrene samples exhibited repeatable dynamic mechanical loss dispersion well above T sub g, analogous to the T sub 11 process observed by torsional braid analysis. A model which predicts that any composite sample consisting of an elastic support and a viscous liquid

must produce such a relaxation, devoid of molecular origin, was proposed. Measurements on 4,000 molecular weight polystyrene and glycerol confirmed these predictions while direct viscometric studies of the former material showed that only simple liquid-like response was observed in a comparable temperature frequency region. Dissert. Abstr.

N79-25228 Illinois Inst. of Tech., Chicago.
THE INTERRELATIONSHIP AMONG SURFACE COMPOSITION, SURFACE RHEOLOGICAL PROPERTIES AND FOAM STABILITY Ph.D. Thesis
Nizar Fouad Djabbarah 1978 154 p
Avail: Univ. Microfilms Order No. 7913091

The effect of surface composition and surface rheological properties on foam stability was investigated. The most stable foam consisted of slow draining lamellae and was produced by solutions which possessed relatively high surface viscosity. The surface composition data indicated that lauryl alcohol displaced sodium lauryl sulfate at the surface. This displacement resulted in the lowering of the critical micelle concentration of sodium lauryl sulfate to an extent which depended on the relative concentration of lauryl alcohol in the bulk. The lowering of the critical micelle was further verified by the presence of a minima in the surface tension-bulk concentration curve. The surface viscosity data indicated that surface dilational viscosity exceeded surface shear viscosity by at least two orders of magnitude. The experimentally measured surface and bulk properties were used to calculate the rupture time of the lamella at different radii of the flat portion of the lamella. Dissert. Abstr.

N79-25229# Canada Inst. for Scientific and Technical Information, Ottawa (Ontario).
A POLYMER MODEL OF MOLTEN SILICATES
O. A. Esin 1979 44 p refs Transl. into ENGLISH from Itogi Nauki Tekh., Rastvory, Rasplavy (USSR), v. 2, 1975 p 76-107
(NRC/CNR-TT-1932; ISSN-0077-5606) Avail: NTIS HC A03/MF A01

Experiments conducted under the assumption that molten silicates are polyionic liquids which contain a range of silicon-oxygen anions in chemical equilibrium inter se and with oxygen ions are reviewed as well as thermochemical studies performed to characterize the ions of molten silicates by studying the activity of silicates in solution. Results show that the greater the cation electrostatic potential, the smaller the deviation from experimental values. The lowest activity which follows from the polymer model adopted proves to be higher than the experimental value. A possible combination of two groups of theories is suggested. A.R.H.

N79-25230*# Celanese Research Co., Summit, N.J.
ULTRATHIN METALLIZED PBI PAPER Final Report
Edward C. Chenevey Dec. 1978 48 p
(Contract NAS2-9526)
(NASA-CR-152281) Avail: NTIS HC A03/MF A01 CSCL 07D

A study to determine the feasibility of preparing ultrathin papers with a target weight of 3.5 g/m squared from polybenzimidazole (PBI) fibrids was undertaken. Small hand sheets of target weight were fabricated. They were light brown, low density materials with sufficient strength to be readily handleable. Characterization of these sheets included strength, fold endurance, thermal gravimetric analysis in air and nitrogen and photomicrographs. Two different batches of PBI fibrids were studied and differences in fabrication performance were noted. In neither case could target weight papers be prepared using conventional paper making techniques. M.M.M.

N79-25231# Battelle Columbus Labs., Ohio.
SOLIDIFICATION OF BOUNDARY LUBRICANT FILMS Final Technical Report, 15 Apr. 1977 - 15 Oct. 1978
E. J. Drauglis and R. J. Jakobsen Dec. 1978 109 p refs
(Contracts F33615-77-C-2026; AF Proj. 2303)
(AD-A067359; AFAPL-TR-78-111) Avail: NTIS HC A06/MF A01 CSCL 11/8

In this research lauric acid, dodecane, solutions of lauric acid in dodecane and a diester E-105 have been studied in a diamond window high pressure cell. Melting and crystallization behavior were studied as functions of pressure, temperature, time, and solution composition, by means of visual microscopic observation and Fourier Transform infrared spectroscopy. Of greatest immediate significance with respect to the development of improved lubricating fluids, are the experiments in which chemical reactions at a simulated bearing surface were studied by coating the diamond windows with a thin layer of iron. In these experiments the formation of an iron salt of lauric acid was followed by infrared spectroscopy. This work demonstrates conclusively the power of this new experimental technique for studying chemical reactions at interfaces not only of model lubricants but also lubricants and additives of practical interest. Author (GRA)

N79-25232# Akron Univ., Ohio. Inst. of Power Science.
NEW POLYTETRAHYDROFURAN GRAFT COPOLYMERS Final Report, 15 Dec. 1975 - 31 Jan. 1979
P. Dreyfuss 15 Mar. 1979 10 p refs
(Grant DAAG29-76-G-0118)
(AD-A067278; ARO-13321.6-C) Avail: NTIS HC A02/MF A01 CSCL 11/9

The discovery that tetrahydrofuran polymerization can be initiated by trifluoromethanesulfonate esters formed in situ from reactive alkyl or polymeric halides and silver trifluoromethanesulfonate has led to this investigation of the synthesis and characterization of a group of novel graft copolymers with potentially interesting and technologically useful combinations of properties. The study has shown that the method is general for heterocycles that will polymerize by cationic ring opening polymerization and that a variety of salts can be substituted for the silver trifluoromethanesulfonate. Properties of the first series of graft copolymers prepared in sufficient quantity for physical testing confirm the expectation that the behavior of the materials produced is related to the chemical structure of the backbone and of the branch, so that copolymers can be tailor-made for specific applications by proper choice of backbone and branch. Author (GRA)

N79-25233# Army Mobility Equipment Research and Development Command, Fort Belvoir, Va.
CORRELATION STUDY OF LABORATORY PHYSICAL AND CHEMICAL DATA WITH DYNAMOMETER ENGINE SEQUENCE PERFORMANCE TESTING OF ENGINE LUBRICATING OILS Technical Report, Sep. 1977 - Sep. 1978
Maryland D. Kemp and Francis E. Council, Jr. Dec. 1978 136 p refs
(AD-A066615; MERADCOM-2262) Avail: NTIS HC A07/MF A01 CSCL 11/8

A statistical study has been made on laboratory physical and chemical data obtained on 80 lubricating oils meeting requirements of Military Specification MIL-L-2104C. The purpose of the study is to seek correlations between laboratory physical and chemical data and dynamometer and field performance. The initial study produced internal and group correlations among the data and suggests a means for relating laboratory-observed chemical and physical data to field performance. Author (GRA)

N79-25234# FRL - An Albany International Co., Dedham, Mass.
DEVELOPMENT OF KEVLAR 29 DECELERATOR MATERIALS Technical Report, Feb. 1977 - Sep. 1978
Norman J. Abbott and Robert J. Coskren Nov. 1978 84 p refs
(Contract F33615-77-C-3007; AF Proj. 2402)
(AD-A066546; AFFDL-TR-78-201) Avail: NTIS HC A05/MF A01 CSCL 11/9

Designs for decelerator systems materials made from Kevlar 29 have been developed consisting of 4 braided cords, 1 sewing thread, 12 ribbons, 10 tapes and webbings, and 2 canopy fabrics. Draft Military Specifications have been written for all of these materials, and sample quantities of each produced.Author (GRA)

N79-25235# Vermont Univ., Burlington. Dept. of Chemistry.
SYNTHESIS,MAGNETIC SUSCEPTIBILITY,AND SPECTROSCOPIC PROPERTIES OF SINGLE-AND MIXED-VALENCE IRON OXALATE, SQUARATE, AND DIHYDROXYBENZOQUINONE COORDINATION POLYMERS
James T. Wrobleski and David B. Brown 16 Mar. 1979 76 p refs
(Contract N00014-75-C-0756; NR Proj. 356-593)

(AD-A066531; TR-15) Avail: NTIS HC A05/MF A01 CSCL 11/9

Magnetic susceptibility data for several Fe(II) coordination polymers containing oxalate or squarate dianions are reported in the temperature range 4.2-300 K. Low temperature magnetism of Fe(C2O4)(H2O)2 is dominated by intrachain ordering near 32 K followed by the onset of interchain long-range order slightly below this temperature. Susceptibility data for Fe(C4O4)(H2O)2 and Fe(C4O4)(C5H5N)2-2H2O show no detectable spin exchange in the temperature range studied. GRA

N79-25236# Systems Research Labs., Inc., Dayton, Ohio. Research Applications Div.

DYNAMIC EVALUATION OF EXPERIMENTAL INTEGRAL FUEL-TANK SEALANTS, PART 2 Final Technical Report, Jul. 1977 - Jun. 1978

William R. Mallory Wright-Patterson AFB, Ohio AFML Nov. 1978 41 p

(Contract F33615-76-C-5253; AF Proj. 2421; AF Proj. 7340) (AD-A066592; SRL-6901-Pt-2; AFML-TR-77-152-Pt-2) Avail: NTIS HC A03/MF A01 CSCL 11/1

An exploratory development program has been performed to investigate and evaluate experimental integral fuel-tank sealant materials under laboratory conditions which closely simulate those of actual aircraft integral fuel tanks during flight. As part of this effort, a unique facility has been designed and fabricated for the evaluation of a variety of joint configurations. The facility consists primarily of a biaxial stress machine in which temperature, pressure, and vibrational strain can be programmed for automatic operation. Specimens can be strained longitudinally and torsionally to simulate actual flight conditions. Frequency and amplitude of the strains can be independently set and recorded. Simulated fuel-tank and environmental pressure can also be adjusted independently. Early difficulties with sealant-failure detection and with undesirable thermal strains have been largely resolved and partial evaluation of continuous-fillet specimens utilizing one sealant material has been performed. A second evaluation apparatus is now under construction. Author (GRA)

N79-25237# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Materials Engineering.

CHEMICAL DURABILITY IMPROVEMENT AND STATIC FATIGUE OF GLASSES Annual Report, 1 Apr. 1978 - 28 Feb. 1979

Minoru Tomozawa Mar. 1979 33 p refs

(Contract N00014-78-C-0315)

(AD-A066978; AR-1) Avail: NTIS HC A03/MF A01 CSCL 11/2

The surface layer of heat-treated borosilicate glasses exhibited lower HF etching rate compared with the bulk. The chemical analysis of the same glass indicated an excess Al2O3 concentration in the surface layer. The low HF etching rate was attributed to the lowering of the immiscibility dome by the excess Al2O3 and the consequent shift of the composition. A prolonged heat-treatment of glasses produced a surface stress layer. This surface stress was found to change its sign when the glass was heat-treated in wet atmosphere. The surface stress was attributed to the different water content in the surface layer from that in the bulk. Chemical durability, especially the etching rate of a glass in hot NaOH solution was found to be reduced by coating the glass with Zr alcoxide. The Zr compound appears to deposit on the etched surface continuously protecting the glass. Direct confirmation of the stress corrosion, i.e., the stress-accelerated reaction of glass with aqueous solution was attempted. Preliminary investigation showed that reactions are accelerated by tensile stress and retarded by compressive stress. Author (GRA)

N79-25238# Army Materials and Mechanics Research Center, Watertown, Mass.

SYNTHESIS OF A THIOPHENE-CONTAINING BISBENZIL AND A DERIVED POLYQUINOXALINE Final Report

Domenic P. Macaione and Stanley E. Wentworth Feb. 1979 16 p refs

(DA Proj. 1L-62705-AH-84)

(AD-A067199; AMMRC-TR-79-6) Avail: NTIS HC A02/MF A01 CSCL 11/9

The development of polyphenylquinoxaline (PPQ) polymers as high-temperature-resistant materials has been hindered, in part, by the high cost of one resin component, 1,4-bis (phenylglyoxaloyl) benzene (PGB). A low-cost synthesis of PGB or PGB-type compounds to be substituted for PGB in the synthesis of PPQ-type polymers is therefore desirable. This report deals with the synthesis of 1,4-bis (2-thienylglyoxaloyl)-benzene (THGB) by the benzoin condensation route in the search for a low-cost replacement for PGB, and its reaction with 3,3 -diaminobenzidine (DAB) to prepare poly(2-thienyl)quinoxaline (PTHQ). Some of the properties of the polymer have been determined and are discussed. Author (GRA)

N79-25239# Oklahoma Univ., Norman. Dept. of Chemistry.

THE CRYSTAL AND MOLECULAR STRUCTURE OF TRIMETHYLTIN CHLORIDE AT 135K: A HIGHLY VOLATILE ORGANOTIN POLYMER

M. Bilayet Hossain, J. L. Lefferts, K. C. Molloy, D. VanderHelm, and J. J. Zuckerman 21 Feb. 1979 12 p refs

(Contract N00014-77-C-0432)

(AD-A067222; TR-7) Avail: NTIS HC A02/MF A01 CSCL 07/3

Trimethyltin chloride is the key starting material in the laboratory synthesis of the trimethyltin derivatives most subject to study. It is an article of commerce, and has itself been extensively studied by a great variety of spectroscopic and physical methods. There is in the literature starting in 1970, a trail of oft referenced private communications which describe a yet unpublished X-ray structure which is incorrect. In addition, the structure of the analogous triphenyltin chloride, which is monomeric at ambient temperature, is said to undergo a change on cooling to a chlorine bridged polymer, but this suggestion is based upon NQR data a 77K which cannot be reproduced. The structure of the homologous trimethyltin fluoride cannot be solved because of disorder, and thus the widely-quoted bridging halide structures for R3SnX compounds are being confirmed here in there case of the title compound for the first time. Solid trimethyltin chloride at 135K is associated through bent chlorine bridges into a one-dimensional polymer containing non-planer C3Sn moieties in a distorted, axially-most electronegative, trigonal bipyramid at tin. Author (GRA)

N79-25049*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.

OUTGASSING OF MATERIALS IN THE SPACE ENVIRONMENT: A THERMOKINETIC APPROACH

T. A. Hughes *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 14-33 refs (For primary document see N79-25048 16-12)

Avail: NTIS HC A99/MF A01 CSCL 07C

N79-25075*# General Electric Co., Philadelphia, Pa. Re-entry and Environmental Systems Div.

SPACE GRADE CHEMICALLY FOAM SILICONE ELASTOMERS

Arnold A. Hiltz *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 781-808 (For primary document see N79-25048 16-12)

Avail: NTIS HC A99/MF A01 CSCL 07C

N79-25078*# Union Carbide Corp., New York. Electronics Div.

PARTICULATE CONTAMINATION: TIE-DOWN WITH PARYLENE C

W. E. Loeb *In* AFML Proc. of USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 863-879 refs (For primary document see N79-25048 16-12)

Avail: NTIS HC A99/MF A01 CSCL 11C

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N79-25240*# Martin Marietta Corp., Denver, Colo.

ANALYSIS AND TEST FOR SPACE SHUTTLE PROPELLANT

DYNAMICS (1/10TH SCALE MODEL TEST RESULTS). VOLUME 1: TECHNICAL DISCUSSION Interim Report, May 1978 - May 1979
Robert L. Berry, James R. Tegart, and Leonard J. Demchak May 1979 84 p refs 2 Vol.
(Contract NAS9-15302)
(NASA-CR-160244; MCR-79-560-Vol-1) Avail: NTIS HC A05/MF A01 CSCL 21I

Space shuttle propellant dynamics during ET/Orbiter separation in the RTLS (return to launch site) mission abort sequence were investigated in a test program conducted in the NASA KC-135 'Zero G' aircraft using a 1/10th-scale model of the ET LOX Tank. Low-g parabolas were flown from which thirty tests were selected for evaluation. Data on the nature of low-g propellant reorientation in the ET LOX tank, and measurements of the forces exerted on the tank by the moving propellent will provide a basis for correlation with an analytical model of the slosh phenomenon. A.R.H.

N79-25241*# Martin Marietta Corp., Denver, Colo.
ANALYSIS AND TEST FOR SPACE SHUTTLE PROPELLANT DYNAMICS (1/10TH SCALE MODEL TEST RESULTS). VOLUME 2: 1/10TH SCALE MODEL TEST DATA Interim Report, May 1978 - May 1979
Robert L. Berry, James R. Tegart, and Leonard J. Demchak May 1979 414 p 2 Vol.
(Contract NAS9-15302)
(NASA-CR-160245; MCR-79-560-Vol-2) Avail: NTIS HC A18/MF A01 CSCL 21I

Thirty sets of test data selected from the 89 low-g aircraft tests flown by NASA KC-135 zero-g aircraft are listed in tables with their accompanying test conditions. The data for each test consists of the time history plots of digitalized data (in engineering units) and the time history plots of the load cell data transformed to the tank axis system. The transformed load cell data was developed for future analytical comparisons; therefore, these data were transformed and plotted from the time at which the aircraft Z axis acceleration passed through l-g. There are 14 time history plots per test condition. The contents of each plot is shown in a table. Author

N79-25242# Air Force Rocket Propulsion Lab., Edwards AFB, Calif.
AN ANALYSIS OF CLIP STRAIN GAGE/SOLID PROPELLANT INTERACTION
Durwood I. Thrasher Oct. 1978 127 p refs
(AF Proj. 5730)
(AD-A066577; AFRPL-TR-77-22) Avail: NTIS HC A07/MF A01 CSCL 21/9

This report covers a detailed analysis of the mechanical interaction between a clip strain gage and a solid propellant uniaxial tensile sample, and the effects of this interaction on the strain measurement provided by the gage. Prototype clip strain gages developed by Thiokol/Huntsville were analyzed and found to produce significant strain measurement bias (original prototype 16 percent bias at 500 psi propellant modulus, final prototype 6 percent bias at 500 psi propellant modulus). Possible clip gage design changes (geometry and materials) to reduce measurement bias are discussed and potentially feasible approaches are identified. The analytical models used are shown to agree closely with 3D finite element analyses and also with experimental measurements made by Thiokol on a gaged propellant sample. GRA

N79-25243# Southwest Research Inst., San Antonio, Tex. Army Fuels and Lubricants Research Lab.
CRUDE AND PRODUCT STORAGE: STATE-OF-THE-ART REVIEW AND ASSESSMENT Final Report, Jun. - Nov. 1978
J. N. Bowden and L. L. Stavinoha Nov. 1978 74 p refs
(Contracts DAAK70-78-C-0001; EL-78-A-01-2185)
(AD-A066605; AFLRL-110) Avail: NTIS HC A04/MF A01 CSCL 15/5

National policy has dictated that large reserves of petroleum be stored in order to diminish U. S. vulnerability to the effects of a severe petroleum supply interruption. To ensure that products being considered for storage would be of a quality immediately usable and to identify likely quality assurance procedures, an investigation program was undertaken. The first task under this program was to review and assess the state-of-the-art in petroleum crude and product storage. Through literature review, questionnaires, and personal contacts, considerable information was identified for use in programs relating to the effect of storage on the quality of finished petroleum products. As a result of this task, it has been determined that underground storage of refined distillate products can be accomplished with proper selection of products to be stored, through specification requirements, quality control/surveillance, and judicious use of additives. Author GRA

N79-25244# Rockwell International Corp., Los Angeles, Calif.
THE IMPACT OF ALTERNATE FUELS ON AIRCRAFT CONFIGURATION CHARACTERISTICS Final Report, Dec. 1977 - Oct. 1978
Douglas A. Robinson Oct. 1978 139 p refs
(Contract F33615-77-C-3155; AF Proj. 2404)
(AD-A066983; AFFDL-TR-78-152) Avail: NTIS HC A07/MF A01 CSCL 21/4

The study dealt with the effect of alternate fuel usage for three classifications of advanced technology vehicles for a post-2000 time period. Alternate fuel design vehicles were configured to optimum thrust loading and wing loading based on hydrocarbon JP-4 fuel, and found to offer 35 to 45 percent weight reduction. Life-cycle cost savings were estimated as a function of fuel cost and showed fuels 10 to 15 times the basepoint resulted in breakeven LCC with the more exotic fuels. Author (GRA)

N79-25245# Mobil Research and Development Corp., Paulsboro, N. J.
FACTORS AFFECTING ELECTROSTATIC HAZARDS Final Technical Report, 15 Apr. 1977 - 15 Jul. 1978
P. W. Kirklin and D. L. Rhynard Dec. 1978 91 p
(Contract F33615-77-C-2047; AF Proj. 3048)
(AD-A066927; AFAPL-TR-78-89) Avail: NTIS HC A05/MF A01 CSCL 21/4

Conductivity additives ASA-3 and Stadis 450 have been found to significantly reduce static electricity in JP-4 containing approved additives when fuel conductivity is at least 100 CU at use temperatures. In the absence of conductivity additives, some additives caused increased charge accumulation which may have contributed to previous static ignited aircraft fires. Tests were performed in a Mobil Research small-scale electrification unit modified to simulate USAF fueling velocities and aircraft fuel tank configurations. Author (GRA)

N79-25246# Army Armament Research and Development Command, Dover, N. J. Large Caliber Weapon Systems Lab.
THE CRYSTAL STRUCTURE DETERMINATION OF TRIAMINOGUANIDINIUM NITRATE: A BURNING RATE MODIFIER FOR NITRAMINE PROPELLANTS
Arthur J. Bracuti Feb. 1979 24 p refs
(DA Proj. 1L1-61101-A-91A)
(AD-A067293; AD-E400296; ARLCD-TR-78050) Avail: NTIS HC A02/MF A01 CSCL 20/2

The crystal and molecular structures of triaminoguanidinium nitrate were determined to ascertain if its unique burning rate behavior is structure related. This was accomplished using single crystal X-ray diffractometry. Triaminoguanidinium nitrate was found to be orthorhombic (space group Pbcm) with unit-cell dimensions: a 8.389(7), b 12.684(8), and c 6.543(5)A. The structure consists of layers of ions parallel to (001) located at + or -1/4c held together by Van der Waals' forces and hydrogen bonding. It was concluded that no definitive explanation for the burning rate behavior could be made until other data were obtained. It was recommended that the charge distribution on each ion be studied with a semi-empirical SCF-MO treatment, that thermal decomposition (gas analysis) and reaction mechanism be determined, and that a wide temperature range (liquid nitrogen temperature to melting point) differential scanning calorimetry (DSC) or differential thermal analysis (DTA) study be undertaken. GRA

N79-25247# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
A FILTERABILITY STUDY OF CORROSION INHIBITED JP-4 Summary Report, Aug. 1974 - Jun. 1976
Paul C. Hayes, Jr. Jun. 1978 68 p refs
(AF Proj. 3048)
(AD-A066887; AFAPL-TR-78-44) Avail: NTIS HC A04/MF A01 CSCL 21/4

The filterability of JP-4 fuel indicates the extent of contamination with solid particulate matter, refinery carry-overs, and/or reaction products generated from the mixing of inhibited fuel and water bottoms. This report examines the creation of filter-plugging precipitants via the interaction of a fuel corrosion inhibitor with entrained water. Further work revealed methods to prevent the formation of the reaction product and steps to reclaim such a synthetically created high filtration time JP-4.
Author (GRA)

N79-25248# Department of Energy, Bartlesville, Okla. Energy Technology Center.
NATIONAL MOTOR GASOLINE SURVEYS: A KEY SOURCE OF FUEL TREND DATA
H. J. Coleman, E. M. Shelton, and C. J. Thompson Aug. 1978 18 p refs
(BETC/RI-78/16) Avail: NTIS HC A02/MF A01

The characteristics, properties, and quality of both winter and summer motor gasolines as obtained on samplings from all 17 major marketing districts of the United States are presented. Data and fuel trends useful for fuel and engine improvements and development of meaningful fuel specifications are provided. The reporting of motor gasoline quality provides some bases for extrapolating to the desired and/or required octane number rating of fuels in the 1980's.
DOE

N79-25249# Aerodyne Research, Inc., Bedford, Mass.
AN ASSESSMENT OF THE POTENTIAL IMPACT OF COMBUSTION RESEARCH ON INTERNAL COMBUSTION ENGINE EMISSIONS AND FUEL CONSUMPTION Final Report, Dec. 1977 - Apr. 1978
J. L. Kerrebrock and C. E. Kolb Jan. 1979 92 p refs
(Contract DOT-TSC-1487)
(PB-290953/9; ARI-RR-131; DOT-HS-803-722; DOT-TSC-NHTSA-78-47) Avail: NTIS HC A05/MF A01 CSCL 21D

The basic thermodynamic, fluid dynamic, and chemical kinetic processes which affect the fuel economy and levels of pollutant exhaust products of diesel, stratified charge, and spark ignition engines are reviewed. Key areas are identified where insufficient understanding currently prevents the rational development of internal combustion engines with improved performance. A research plan designed to gather the needed data is presented.
GRA

N79-25063*# ARO, Inc., Arnold Air Force Station, Tenn.
IR OPTICAL PROPERTIES OF BIPROPELLANT CRYOCONTAMINANTS
J. A. Roux, B. E. Wood, A. M. Smith, J. G. Pipes, and H. E. Scott (AEDC) *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 412-455 refs (For primary document see N79-25048 16-12)
Avail: NTIS HC A99/MF A01 CSCL 21I

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N79-25250 Clarkson Coll. of Technology, Potsdam, N.Y.
MECHANISM AND STRUCTURAL DESIGN VIA OPTIMALITY CRITERION TECHNIQUES Ph.D. Thesis
Mohsin Raza Khan 1979 181 p
Avail: Univ. Microfilms Order No. 7906078

Widely applicable optimization techniques to the design of large scale structures and complex high speed planar mechanisms under vibrational effects were developed. The optimization techniques are based on optimality criterion methods. The structural analysis is performed using a standard finite element method. However, in order to save computational time, a super-sub finite element concept is introduced for the analysis of frames having variable cross-sectional members. The mechanisms analysis is done using the constant length finite element technique. Also, a modified finite element technique is developed to analyze mechanisms having variable cross-sectional size links. The optimality criterion techniques developed were very successfully applied to the design of trusses, beams, frames and high speed planar mechanisms.
Dissert. Abstr.

N79-25251# Civil and Environmental Engineering Development Office, Tyndall AFB, Fla.
EVALUATION OF MATERIALS FOR POST-ATTACK PAVEMENT REPAIR Final Report, Sep. 1976 - Dec. 1977
C. L. Rone and A. L. Sullivan, III Sep. 1978 107 p refs
(AF Proj. 2104)
(AD-A066516; CEEDO-TR-78-16) Avail: NTIS HC A06/MF A01 CSCL 01/3

This study was conducted to evaluate the performance of candidate materials used to repair small damaged areas in pavement when subjected to traffic by an F4C aircraft loading. The study consisted of preparing simulated damaged areas in portland cement concrete pavement and flexible pavement and repairing the areas with selected materials. The evaluation was based on the performance of the repaired areas when subjected to accelerated traffic with a loading equivalent to one main gear of the F4C aircraft.
Author (GRA)

N79-25252# Forecasting International Ltd., Arlington, Va.
US ARMY METRICATION: ANALYSIS AND RECOMMENDATIONS FOR DA IMPLEMENTATION PLAN. VOLUME 2: ANNEXES
M. J. Cetron, L. A. Roepcke, C. F. McFadden, S. E. Sugarek, and E. B. Peters Jun. 1978 156 p
(Contract DAAG39-77-C-0108)
(AD-A066984) Avail: NTIS HC A08/MF A01 CSCL 14/2

Contents: U.S. Trade Statistics by Industry; Public Law 94-168--Metric Conversion Act of 1975; Statistical Data on U.S. Companies with Metrication Experience; ANMC Sector Conversion Plans--Highway vehicles, Electrical goods, Construction and agricultural equipment, and Instruments; DoD Directive 4120.18--Use of the metric system of measurement; AR 700-1--Army conversion to the metric system of measurement; RSI and International Activities; Training Programs; Impact of Metric Conversion on Army Logistics Functions; Guidelines for Monitoring U.S. Metric Progress; Impact of Metrication on Army Regulations; Project Manager's Checklist; and Recommended Changes to AR-700-1.
GRA

N79-25253# Purdue Univ., Lafayette, Ind. School of Engineering.
INTEGRATED APPROACH TO CAVITY SYSTEM SEISMIC EVALUATION Final Report
Basile Dendrou Oct. 1978 323 p refs Sponsored by the Federal Highway Administration, Washington, D. C.
(PB-292090/8; FHWA/RD-78/159) Avail: NTIS HC A14/MF CSCL 13M

A methodology was developed to compare different design alternatives of a cavity system. The rock media was assumed to be isotropic both in the physical and statistical sense. Computations were performed for each design alternative, in a two-dimensional geometric framework using triangular and beam type finite elements.
GRA

N79-25254# National Bureau of Standards, Washington, D. C. Center for Building Technology.
THE DEVELOPMENT OF AN IMPROVED COMPRESSION TEST METHOD FOR WALL PANELS Final Report
C. W. C. Yancey and L. E. Cattaneo Feb. 1979 112 p refs Sponsored in part by the Dept. of Housing and Urban Development, Washington, D. C.
(PB-292304/3; NBS-BSS-95) Avail: NTIS HC A06/MF A01 CSCL 13M

Panels were tested to failure under either of two different eccentricities of load, while being supported with one of two types of idealized end conditions. A computer-aided analytical study of the variables affecting the degree of uniformity of loading was conducted. Equations based on the analogy of beams

supported on elastic foundations were used in the analysis. A compression test method applicable to traditional and innovative wall constructions is presented. The principal additions in the revised test method are as follows: (1) a provision for variable eccentricity, and (2) a procedure for selecting a load distribution assembly which will be compatible with the test panel. GRA

N79-25255# California State Dept. of Transportation, Sacramento. Transportation Lab.
CONTROL OF SLOPE EROSION USING FIBERGLASS ROVING WITH VEGETATION Final Report, Jul. 1977 - Oct. 1978
M. E. Nolan and R. J. Spring Oct. 1978 104 p refs Sponsored in part by DOT
(Contract DOT-F-5-18)
(PB-292667/3; FHWA/CA-78/4) Avail: NTIS HC A06/MF A01 CSCL 13B

A total of three sites were treated. Also, four additional sites that were previously treated under other projects were evaluated. The test sites were monitored with photographs, sediment troughs to determine erosion rates, field observation for vegetation emergence, and precipitation measurement. The fiberglass roving with vegetation was effective in reducing erosion at all the sites. Grasses, seeded prior to treatment, emerged through the fiberglass mat with little difficulty. The installed cost of the treatment was high (approximately $4,500 per acre) and should only be used in problem areas and special cases. GRA

N79-25256# Missouri State Highway Dept., Jefferson City. Div. of Materials and Research.
AN INVESTIGATION OF SKID RESISTANT ASPHALTIC MIX DESIGNS Final Report
Dec. 1978 133 p ref Sponsored in part by Federal Highway Admin.
(PB-292091/6; MCHRP-74-4; FHWA/RD/MO-79/74/4) Avail: NTIS HC A07/MF A01 CSCL 13C

The durability of skid resistance of some flexible pavement surface mixes constructed using special aggregates which were found to produce surface with improved skid resistance is discussed. The ability of these mixes to maintain an improved level of skid resistance is unknown. Evaluation of this ability involved determining the influence of traffic volumes and accumlated traffic on the improved frictional characteristics. Data on a majority of test sections did not provide reliable wear factors from which to judge the potential future value of the mixes. These test sections were judged on average skid numbers for the sections and variability of skid numbers over the testing period. GRA

N79-25257# Materials Research and Development, Inc., Oakland, Calif.
MINIMIZING PREMATURE CRACKING IN ASPHALTIC CONCRETE PAVEMENT Final Report
F. N. Finn, K. Nair, and J. M. Hilliard Washington Transportation Res. Board. Oct. 1978 61 p refs Sponsored in part by Federal Highway Admin. and Am. Assoc. of State Highway and Transportation Officials
(PB-292417/3; TRB/NCHRP/REP-195; ISBN-0-309-02855-8; ISSN-0077-5614; LC-78-65952) Avail: NTIS HC A04/MF A01 CSCL 13C

Research was conducted: (1) to prepare a series of recommendations dealing with materials specifications mix design structural materials selection, and construction requirements that can be used by asphalt pavement designers to reduce the possibility of premature cracking in the pavement, and (2) to suggest procedures for verification of the recommendations. All available information from recent and current research and field experience was reviewed and evaluated. Recommendations were prepared for minimizing fatigue, low temperature and reflection cracking. A procedure, using Bayesian analysis methodology, is suggested for verification of the recommendations for minimizing premature cracking. GRA

N79-25258# California State Dept. of Transportation, Sacramento. Office of Transportation Lab.
AN INVESTIGATION OF THE EFFECTIVENESS OF ASPHALT DURABILITY TESTS: INITIAL PHASE Interim Report
N. H. Predoehl and G. R. Kemp Aug. 1978 46 p refs Sponsored by Federal Highway Admin.
(PB-292002/3; TL-633133; FHWA/CA/TL-78/26) Avail: NTIS HC A03/MF A01 CSCL 13C

The design, mixing, compaction, and field installation of the briquettes are reported which were prepared at three void content ranges using three asphalts and two different aggregates and then weathered at four different climatic sites. Approximately 900 briquettes were placed in special weathering trays at sites located in coastal, desert, valley and mountain environments. Test results obtained using various laboratory procedures on the three asphalts are included. GRA

N79-25259# California Univ., Berkeley.
RATIONAL DESIGN METHODS FOR LIGHT EQUIPMENT IN STRUCTURES SUBJECTED TO GROUND MOTION
Jerome L. Sackman and James M. Kelly Sep. 1978 72 p refs
(Grant NSF ENG-77-05197)
(PB-292357/1; UCB/EERC-78/19; NSF/RA-780541) Copyright. Avail: NTIS HC A04/MF A01 CSCL 13M

An analytical method is developed whereby a simple estimate can be obtained of the maximum dynamic response of light equipment attached to a structure subjected to ground motion. The natural frequency of the equipment modeled as a single-degree-of-freedom system, is considered to be close, or equal, to one of the natural frequencies of the N-degree-of-freedom structure. This estimate provides a convenient, rational basis for the structural design of the equipment and its installation. The approach is based on the transient analysis of lightly damped tuned or slightly detuned equipment-structure systems in which the mass of the equipment is much smaller than that of the structure. GRA

N79-25260# Office of Radiation Programs, Las Vegas, Nev.
LEVELS AND DISTRIBUTION OF ENVIRONMENTAL PLUTONIUM AROUND THE TRINITY SITE Final Report
Richard L. Douglas Oct. 1978 56 p refs
(PB-290994/3; ORP/LV-78/3) Avail: NTIS HC A04/MF A01 CSCL 18H

The levels and distribution of plutonium resulting from the detonation of the Trinity device in 1945 were studied. A total of 88 soil samples were collected, covering an area of roughly 4500 square miles. Air samples were collected during 1975 at a location within the Trinity fallout pattern, and at another site outside the pattern. All samples were analyzed for plutonium 239,240 by Alpha spectroscopy, and some were analyzed by mass spectroscopy for both nuclides. The results indicate that most of the area sampled contains detectable amounts of Trinity plutonium in the surface 5 cm of soil. The highest levels of plutonium 239,240 deposition in soil (in unrestricted areas) were on the order of 90 nCi/sq m. The air samples at the site within the fallout pattern contained about 50 percent Trinity plutonium, but the average concentration of airborne plutonium at the two locations was the same. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

N79-25261# Defense Communications Agency, Arlington, Va.
ARPANET INFORMATION BROCHURE
Feb. 1979 30 p
(AD-A066226; AD-E100188) Avail: NTIS HC A03/MF A01 CSCL 17/2

ARPANET is an operational, resource sharing inter-computer network linking a wide variety of computers in CONUS, Hawaii, Norway, and England. Its communications system introduced the revolutionary technique of 'packet switching' where each message is broken up into small packets and each packet is switched to its destination over the quickest communications path available at any given instant. This brochure provides a general description

of the ARPANET and defines the policies and procedures governing its use. GRA

N79-25262*# Mitre Corp., Houston, Tex.
SPECIFICATION FOR INSTALLATION OF THE CREW ACTIVITY PLANNING SYSTEM COAXIAL CABLE COMMUNICATION SYSTEM
M. A. Allen and G. S. Roman Apr. 1979 33 p refs
(Contract F19628-79-C-0001; NASA Order T-5295-F; AF Proj. 8470)
(NASA-CR-160247; MTR-4726; JSC-14869) Avail: NTIS HC A03/MF A01 CSCL 17B

The specification used to install a broadband coaxial cable communication system to support remote terminal operations on the Crew Activity Planning system at the Lyndon B. Johnson Space Center are reported. The system supports high speed communications between a Harris Slash 8 computer and one or more Sanders Graphic 7 displays. G.Y.

N79-25263# TRW Defense and Space Systems Group, Redondo Beach, Calif.
FINITE ELEMENT APPLICATION TO TRANSIENT SCATTERING PROBLEMS Interim Report, Jan. 1978 - Mar. 1979
A. Sankar and T. C. Tong Mar. 1979 73 p refs
(Contract F49620-78-C-0049; AF Proj. 2301)
(AD-A067269; TRW-79-001; AFOSR-79-0450TR) Avail: NTIS HC A04/MF A01 CSCL 20/3

Finite element method is applied to compute the induced current distributions on thin wires in the time domain. The required mathematical equations and computer code are developed. The predictions by this method compare very well with other techniques. Advantages of this approach are mentioned. Author (GRA)

N79-25264# Santa Barbara Research Center, Goleta, Calif.
DEVELOPMENT OF LARGE AREA PV HgCdTe DETECTORS FOR 2.06 AND 3.85 MICROMETERS Interim Report, 5 Jan. 1976 - 15 Jun. 1977
P. R. Bratt 31 May 1978 163 p refs
(Contract DAAB07-76-C-0803)
(AD-A067306) Avail: NTIS HC A08/MF A01 CSCL 17/5

The purpose of this program was to develop large area PV HgCdTe detectors for laser receiver systems operating at 2.06 micrometers (Ho:YLF laser) and 3.85 micrometers (DF laser). The work accomplished included: Evaluation of three different methods of crystal growth, the preparation of low acceptor concentration p-type base material by means of gold diffusion, development of a junction formation method utilizing boron ion implantation, and evaluation of those detector characteristics which control operation in the 1 MHz region. GRA

N79-25265# New Mexico State Univ., Las Cruces. Physical Science Lab.
THEORETICAL INVESTIGATION OF THE MICROSTRIP ANTENNA Semiannual Progress Report
Keith R. Carver 23 Jan. 1979 93 p refs
(Grant DAAG29-78-G-0082)
(AD-A067311; PT-00929; ARO-15384.1-EL) Avail: NTIS HC A05/MF A01 CSCL 09/5

This report begins with a discussion of a general mathematical framework for the analysis of microstrip antennas. A discussion is then presented of methods based on the finite elements approach along with key aspects of a computer code developed along these lines. Next, a classical modal expansion method is presented and applied to both rectangular and circular patches. Finally, the finite-elements approach is used to solve for the magnetic currents on the radiating walls of a five-sided patch which can produce circular polarization. Author (GRA)

N79-25266# SRI International Corp., Menlo Park, Calif.
EMP SIMULATOR - SITE INTERACTION Final Report, 1 Mar. - 31 Oct. 1976
A. L. Whitson and W. E. Scharfman Mar. 1978 109 p refs
(Contract DNA001-76-C-0026)
(AD-A067280; AD-E300478; DNA-4553F) Avail: NTIS HC A06/MF A01 CSCL 20/14

EMP simulators interact with test objects and subsequently do not provide a test excitation environment that equals that of the threat EMP. This study compares the excitation from a horizontal simulator (TEMPS) to that from a horizontal EMP (HEMP). This comparison is made on a geometric scale model of an idealized communications facility. TEMPS is shown to be able to excite the facility and its external penetrations at threat-like levels, but cannot duplicate threat excitations. By analyzing a site for its critical penetration-to-critical-circuit coupling paths, often a TEMPS position can be found that will excite the site to threat-like levels. Author (GRA)

N79-25267# California Univ., Los Angeles. School of Engineering and Applied Science.
MODE COUPLING OF MODULATIONAL INSTABILITIES Interim Report.
Lewis C. Himmell Aug. 1978 28 p refs
(Grant AF-AFOSR-2662-74)
(AD-A066723; UCLA-ENG-7858; AFOSR-79-0368TR) Avail: NTIS HC A03/MF A01 CSCL 20/14

A general formalism is developed to describe the nonlinear evolution associated with the parametric decay of an intense, coherent electromagnetic wave into an electrostatic wave, its second harmonic, and scattered electromagnetic waves in a homogeneous plasma. The effects of pump depletion are neglected and it is assumed that all waves are coherent. Two classes of solutions are found. One class is explosively unstable, while the other consists of growing aperiodic oscillations. The evolution of modulational modes is discussed. Author (GRA)

N79-25268# Cambridge Acoustical Associates, Inc., Mass.
DISPERSION AND CUT-OFF PHENOMENA IN RODS AND BEAMS, PHASE 1 Final Report, 1 Jan. - 30 Sep. 1978
Miguel C. Junger and John E. Cole, III Oct. 1978 41 p refs
(Contract N00014-78-C-0210)
(AD-A066491; CAA-U-573-260) Avail: NTIS HC A03/MF A01 CSCL 09/1

This study was proposed to ONR Structural Mechanics Program as a result of in-house research which led to the conclusion that uniform structural waveguides of small transverse dimensions (1) display a vanishing impedance at every modal cut-off frequency; (2) that each cut-off frequency coincides with the natural frequency of the corresponding standing-wave mode of the cross section, the modal configuration being independent of the z-coordinate defined here as the coordinate along the waveguide axis. The preliminary study was restricted to homogeneous waveguides whose cross-section and material properties are z-independent. Furthermore, as already stated the analysis was limited to waveguides whose transverse dimension was small enough to eliminate thickness vibrations, e.g. Euler beams on distributed springs, simply-supported strips, and thin cylindrical shells. GRA

N79-25269# Defense Communications Engineering Center, Reston, Va.
AN ALGORITHM FOR PREDICTING THE PERFORMANCE OF A VOICE NETWORK WITH PREEMPTION
D. Calabrese, M. Fischer, B. Hoeiem, and E. Kaiser Jan. 1979 41 p refs
(AD-A066454; AD-E100191; DCEC-TN-6-79) Avail: NTIS HC A03/MF A01 CSCL 17/2

In order to evaluate the potential impact of facsimile-imagery service upon the current and future Automatic Voice Network (AUTOVON) and to reduce the time required to perform worldwide AUTOVON Flash Non-Blocking (FNB) Studies, the capability of the DCEC Voice Network Model has been extended from a single class traffic model to a two class traffic model. As in the AUTOVON system, one class of traffic can preempt the other class of traffic. Both ruthless and friendly preemption disciplines have been incorporated in the model for either originating office or spill control. The DCEC Voice Network model has been used to perform engineering studies of AUTOVON, a worldwide circuit switched telephone system. GRA

N79-25270# Illinois Univ. at Urbana-Champaign. Electromagnetics Lab.
SOURCE EXCITATION OF AN OPEN, PARALLEL-PLATE WAVEGUIDE. NUMERICAL RESULTS, SUPPLEMENT
V. Krichevsky Oct. 1978 26 p Supplement to UIEM-78-4
(AD-A066720; UIEM-78-13; UILU-ENG-78-2555;

AFOSR-79-0370TR) Avail: NTIS HC A03/MF A01 CSCL 20/14

In Electromagnetics Laboratory Report No. 78-4, we have calculated the electromagnetic fields as functions of beta, the normalized propagation constant in the z-direction. At the request of Dr. D. Giri of SAI, we have now derived additional numerical results for parameters which correspond to those of the experimental parallel-plate structure being investigated at Harvard. The asymptotic analysis presented in our report 78-4 was based on the assumption (kL > 1). Consequently, great care should be exercised when the range of application of these formulas is extended below kL = 10. GRA

N79-25271# RCA Labs., Princeton, N. J.

X-BAND SOLID-STATE MODULE FOR AIRBORNE ARRAY RADAR APPLICATIONS Final Report, 1 Oct. 1976 - 30 Sep. 1978

R. L. Ernst and H. C. Huang Nov. 1978 85 p refs

(Contract N00173-76-C-0383)

(AD-A066609; PRRL-78-CR-50) Avail: NTIS HC A05/MF A01 CSCL 17/9

This final report summarizes the results achieved in a 21-month research program (including a 3-month no-cost extension) to develop an amplifier module suited to airborne active array radar applications. During the course of this program, advances have been made in the areas of GaAs substrate preparation, design of new FET types having improved performance, fabrication of amplifiers having greater than 1-W output over the 9- to 10-GHz frequency range, and development of pulsed phase characterization techniques which demonstrate the suitability of power FET amplifiers for a pulsed phased array. RCA now has three AsH3/Ga/HCl/H2 (hydride) and one AsCl3/Ga/H2 (trichloride) reactors. These reactors have been used extensively in a program to develop improved buffer layers on GaAs substrates suitable for FET fabrication. Cr-doped buffer layers have been developed with excellent surface morphology, voltage breakdowns in excess of 1500 V and resistivities of about 10 to the 7th power ohm-cm. Undoped buffer layers have been grown using the two-buffer AsCl3 system and resistivities of about 100,000 ohm-cm have been achieved. In the course of this program, new power FET types have been developed which achieve greater power levels than had previously been available. A unit having eight parallel gates, designated as an 8G type, has achieved a power of 854 mW at 10 GHz with over 28% power-added efficiency. GRA

N79-25272# Syracuse Univ., N. Y. Dept. of Electrical and Computer Engineering.

A STUDY OF A REACTIVELY LOADED FINITE PLANAR RECTANGULAR WAVEGUIDE ANTENNA ARRAY

John Luzwick and Roger F. Harrington Feb. 1979 125 p refs

(Contract N00014-76-C-0225)

(AD-A066566; TR-79-2; TR-9) Avail: NTIS HC A06/MF A01 CSCL 09/5

An analysis of a general class of antenna arrays, specifically the reactively loaded parasitically excited waveguide-backed aperture antenna array, is presented. The antenna arrays considered have a single waveguide-fed aperture, no complex feed network to all of the apertures, and one reactive load (shorted waveguide) for each remaining aperture. By varying the position of the short circuits, a directive beam can be steered through 180 deg in space. Only partial control of the array characteristics is possible using this scheme. However, the simplicity of antenna feed design and ease of pattern control makes reactive loading attractive. The antenna arrays investigated have both linear and two dimensional lattices. Each antenna is characterized in terms of power gain, bandwidth, and match. Several examples of magnitude pattern synthesis are presented to show antenna pattern limitations for a given antenna geometry and excitation. In addition, an example using a double-frequency synthesis procedure is given for reshaping gain versus frequency characteristics in the endfire directions. In this direction, gain is higher and bandwidth lower than in other directions. The reactive loading equations for gain and synthesis error are nonlinear equations which normally cannot be solved analytically. Therefore, numerical techniques (optimization algorithms) are used to find reactive loads for both maximum gain in a specified direction and a synthesized pattern. GRA

N79-25273# Weapons Systems Research Lab., Adelaide (Australia).

CALCULATION OF THE RADII OF CURVATURE OF SHORT-WAVELENGTH ELECTROMAGNETIC WAVES AFTER SPECULAR REFLECTION FROM SIMPLE SHAPE CONDUCTORS

L. A. Nicholls Aug. 1978 18 p

(AD-A066538; WSRL-0030-TR) Avail: NTIS HC A02/MF A01 CSCL 17/9

Deschamp's matrix relations for the curvature of short-wavelength electromagnetic rays when specularly reflected from smooth conducting surfaces are reviewed and applications of these relations to double-bounce radar cross section estimation are discussed. Author (GRA)

N79-25274# Naval Postgraduate School, Monterey, Calif.

OPERATION AND PERFORMANCE OF A SINGLE CHANNEL PCM CODEC VOICE TRANSMISSION SYSTEM M.S. Thesis

Michael D. Kyriazanos Dec. 1978 84 p refs

(AD-A066359) Avail: NTIS HC A05/MF A01 CSCL 17/2

A new monolithic LSI product has recently been developed for the telecommunications market. The device is a coding-decoding circuit called a codec that converts analog voice signals into digital bit streams and back to analog form. Its primary application is in telephone channel banks, where its low cost makes per channel coding and decoding of voice signals economically feasible. In this work such a codec set is used in conjunction with two hybrid filters as the main components of a single channel voice transmission system. The operation and the performance of this system are presented. Author (GRA)

N79-25275# Naval Postgraduate School, Monterey, Calif.

DESIGN AND PERFORMANCE OF A SPREAD SPECTRUM DATA COMMUNICATIONS SYSTEM USING DELTA MODULATION WITH A DITHERED CLOCK M.S. Thesis

Evangelos Vassilios Pappas and James Harvey Hoffman Dec. 1978 98 p refs

(AD-A066358) Avail: NTIS HC A05/MF A01 CSCL 17/2

Digital modulation schemes and spread spectrum techniques are of major importance in modern communications. This thesis investigates a delta modulation/demodulation scheme and direct sequence spreading of the digital data. The clock rate is dithered to enhance the low probability of intercept advantage of spread spectrum. The circuitry incorporates small and medium scale integrated circuits. Experimental results are presented in some detail. Good quality voice and music were recovered using a fixed bit rate as low as 10 kbits/sec and a clock dither range of 40%. Author (GRA)

N79-25276# Naval Postgraduate School, Monterey, Calif.

DESIGN AND PERFORMANCE OF A FREQUENCY HOPPING COMMUNICATIONS SYSTEM USING DELTA MODULATION M.S. Thesis

Habib Kucukoglu Dec. 1978 53 p refs

(AD-A066372) Avail: NTIS HC A04/MF A01 CSCL 17/4

A way to increase jamming immunity and to decrease the intercept probability of a communication system is to use spread spectrum (SS) techniques. In this report a frequency hopping SS system (transmitter and receiver) is presented. This system is designed, built, and tested to send and receive digitized voice by utilizing a single chip delta modulator/demodulator. The report describes the circuitry employed, lists the important parameters of the system and includes photographs of various waveforms. The recovered audio is of good quality using digital data rates as low as 25 kilobits per second. A hopping rate of 100 hops per second is used in the design. Author (GRA)

N79-25277# Naval Postgraduate School, Monterey, Calif.

STOCHASTIC SEPARATION OF RADAR SIGNALS Ph.D. Thesis

Zach Weiss Shlomo Dec. 1978 225 p refs

(AD-A066367) Avail: NTIS HC A10/MF A01 CSCL 17/9

There has been a continuing problem of estimating a radar signal when the noise and the signal have the same power

spectra. This is particularly troublesome when one tries to resolve two close targets with a tracking radar. The purpose of this research is to show theoretically that there are practical ways to solve the problem. Two approaches are introduced here. The first is to add a process filter to the radar, and the second is to design a new measuring technique with processing such that the signals will be separable. These two main approaches have led to several new or extended theories which were developed in the course of this work: the Probability filter; a modified Kalman filter (MKF); a measurement modification technique for monopulse radar; and a new approach to the design of a monopulse tracking radar. Simulations were performed to check the two major theories (the M.K.F. and the probability filter). According to the simulations we can say that a tracking radar can be modified in order to solve the problem of separating unresolved targets. Author (GRA)

N79-25278# Army Materiel Systems Analysis Activity, Aberdeen Proving Ground, Md.
A COMPUTER PROGRAM FOR DOUBLE SWEEP OPTIMAL SMOOTHING
Robert A. Scheder Jan. 1979 74 p refs
(DA Proj. 1R7-65706-M-541)
(AD-A066512; AMSAA-TR-246) Avail: NTIS HC A04/MF A01 CSCL 17/9

This report documents the double sweep smoothing program used at AMSAA to determine an aircraft's position, velocity, and acceleration from radar tracking data. It includes a tutorial guide to the underlying mathematics. A quadratic programming problem with linear constraints is formulated, reduced to a system of difference equations with initial and endpoint boundary conditions, and solved using Bryson's double sweep method. The iterative solution is programmed in simple, machine independent FORTRAN with top down structured programming. A listing is supplied and card decks are available. GRA

N79-25279# Naval Ocean Systems Center, San Diego, Calif.
MARCONI AERIAL OUTFIT H-33-5500-01 EVALUATION: COMPARISON OF THIS ACTIVE ANTENNA WITH TWO PREVIOUSLY EVALUATED ACTIVE ANTENNAS Test and Evaluation Report, Apr. - Sep. 1978
E. A. Thowless 25 Oct. 1978 33 p refs
(AD-A066402; NOSC/TR-361) Avail: NTIS HC A01/MF A01 CSCL 17/2

The Marconi H-33-5500-01 antenna has significantly better noise figure and gain that either the Bayshore or DUK antenna; but, as with all active antennas, self-generated intermodulation product interference is likely where several nearby rf transmissions occur simultaneously. Despite this susceptibility, this antenna is judged to be well engineered and properly designed and optimized for integration into hf receiving systems. Because of its small size, it could serve as a backup receiving antenna for hf and lower frequencies aboard Navy ships. Relationships are presented for apparent effective height, antenna noise power output, antenna noise figure, antenna gain, operating noise figure of a complete receiving system, and intermodulation intercept points, ratios, and product levels. Author (GRA)

N79-25280# Shape Technical Center, The Hague (Netherlands).
THE COMBINED US/NATO DIGITAL TROPOSCATTER TEST PROGRAMME OVER TWO ACE HIGH LINKS Final Report
P. Nielsen, J. Osterholz (Defense Commun. Eng. Center), E. Pusone, and I. Vogt Dec. 1978 286 p refs
(AD-A066380; AD-E100189; STC-CR-NICS-38; DCEC-TR-12-78) Avail: NTIS HC A13/MF A01 CSCL 17/2

The combined US/NATO Digital Troposcatter Test Programme was carried out by the Defense Communications Engineering Center (for the US) and the SHAPE Technical Centre (for NATO) between January and August 1977 over two ACE High links in Central Europe which were made available to NATO. The purpose of the tests was to obtain performance data on a multichannel digital troposcatter system using operational communications links. This report contains a description of the equipment and procedures employed, a summary of the results, and the conclusions drawn from the tests. The data obtained has been incorporated in an extensive data base held at both DCEC and STC to provide the capability for future analyses. Author (GRA)

N79-25281# BDM Corp., Albuquerque, N. Mex.
EXEMPT USERS MANUAL Final Report
Jan. 1979 107 p
(Contract F29601-76-C-0122; AF Proj. 3763)
(AD-A066806; AD-E200262; BMA/A-76-140-TR-R2; AFWL-TR-77-207) Avail: NTIS HC A06/MF A01 CSCL 20/14

This volume describes the use of the EXEMPT computer program for the creation, maintenance and modification of a data base to support electromagnetic coupling analysis for linear systems. Use of the EXEMPT Command Language, FORTRAN Mathematical functions, EXEMPT library functions, and data display operations is presented. Interface requirements for user provided subroutines and other programs are defined. Author (GRA)

N79-25282# BDM Corp., Albuquerque, N. Mex.
EXEMPT PROGRAMMERS MANUAL Final Report
Jan. 1979 107 p
(Contract F29601-76-C-0122; AF Proj. 3763)
(AD-A066807; AD-E200261; BMA/A-77-098-TR-R2; AFWL-TR-77-206) Avail: NTIS HC A06/MF A01 CSCL 20/14

EXEMPT is a computer program which functions as an executive routine that interfaces with computer program models describing electromagnetic pulse EMP coupling to aircraft subsystems. As it now exists, EXEMPT is a modification of an earlier version which was difficult to use and which could be used only with B-1 aircraft subsystem models. It was necessary to modify that version to produce a code which would be more user oriented and which could interface with computer program models of EMP coupling to other aircraft subsystems. These modifications have been accomplished, and this report documents the result. Author (GRA)

N79-25283# General Electric Co., Santa Barbara, Calif.
WEDCOM 4: A FORTRAN CODE FOR THE CALCULATION OF ELF, VLF, AND LF PROPAGATION IN A NUCLEAR ENVIRONMENT. VOLUME 2: COMPUTER ROUTINES Topical Report, 15 Oct. 1977 - 1 Nov. 1978
Warren S. Knapp and Royden R. Rutherford 1 Nov. 1978 146 p Supersedes DNA-2875F
(Contract DNA001-78-C-0043)
(AD-A066812; AD-E300474; DNA-4422T-2; DNA-2875F; GE77TMP-33-Vol-2) Avail: NTIS HC A07/MF A01 CSCL 20/14

This document describes computer routines used in WEDCOM IV, a computer code that calculated ELF, VLF, and LF electric and magnetic field strengths in nuclear disturbed environments. GRA

N79-25284# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
INTEGRATED CIRCUIT ELECTROMAGNETIC SUSCEPTIBILITY INVESTIGATION, PHASE 3 Summary Report
J. M. Roe, J. R. Chott, T. W. Herron, C. N. Kohlberg, and C. E. Larson 5 Jan. 1979 23 p refs
(Contract N60921-76-C-A030)
(AD-A066636; MDC-E19999; NSWC/DL-TR-79-14; SR-3) Avail: NTIS HC A02/MF A01 CSCL 20/14

This report summarizes progress made in investigations into the RF susceptibility of integrated circuits ICs. This report covers the work performed during the third of three increments. Included is a description of the revisions which were incorporated into the Integrated Circuit Electromagnetic Susceptibility Handbook Report MDC E1929 dated 1 August 1978 which summarized all of the information obtained during the entire program in a handbook format for use by designers and EMC engineers. Results of tests of the susceptibilities of integrated circuits performed during this increment are described. Models of rectification in PN junctions developed during this increment are described. Simulations of interference effects in TTL NAND gates and 741 OP AMPs are included using computer-aided circuit analysis techniques and a modifier Ebers- M011 transistor model which includes interferences effects. Jitter effects due to RF interference in data transmission systems are discussed. This report includes a brief description of two Electromagnetic Susceptibility Seminars which were held during this increment. Author (GRA)

N79-25285# R and D Associates, Marina Del Rey, Calif.
ON THE IONOSPHERIC PARAMETERS WHICH GOVERN HIGH LATITUDE ELF PROPAGATION IN THE EARTH-IONOSPHERE WAVEGUIDE Topical Report, 16 Oct. 1977 - 30 Sep. 1978
Carl Greifinger and Phyllis Greifinger 30 Sep. 1978 32 p refs
(Contract DNA001-78-C-0009)
(AD-A066608; RDA-TR-107005-004; DNA-4685T) Avail: NTIS HC A03/MF A01 CSCL 20/14

An approximate wave solution is obtained for the propagating ELF mode at high latitudes in the Earth-ionosphere waveguide. A simple approximate expression for the complex propagation constant emerges from the solution. The propagation constant depends on four parameters, two altitudes and a scale height associated with each altitude. The lower altitude is the height at which the conduction current parallel to the magnetic field becomes equal to the displacement current. The associated scale height is the local scale height of the parallel conductivity. Under daytime ionospheric conditions, the upper altitude is the height at which the local wave number becomes equal to the reciprocal of the local scale height of the refractive index. The associated scale height is the local scale height of the refractive index. Under the simplest nighttime conditions, the second set of parameters is replaced by the altitude of the E-region bottom and the local wave number just inside the E-region. The relative phase velocity depends, in first approximation, only on the ratio of the two altitudes. The attenuation rate depends on the other two parameters, as well. The two principal attenuation mechanisms are Joule heating by longitudinal currents in the vicinity of the lower altitude and energy leakage of the whistler component of the ELF wave at the upper altitude. Author (GRA)

N79-25286# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
COMBINATION FREQUENCY AND VLF-ELF GENERATIONS THROUGH HIGH-POWER HF HEATING OF D-REGION IONOSPHERE Final Report, 1 Nov. 1976 - 31 Oct. 1978
A. J. Ferraro and H. S. Lee Feb. 1979 62 p refs
(Contract N00014-77-C-0041)
(AD-A066151; PSU-IRL-FR-79/1) Avail: NTIS HC A04/MF A01 CSCL 17/2

This report describes the outcome of a preliminary study of non-linearities in the D-region ionosphere by heating the region with high power HF radio waves. The ultimate objective of the study was in determining the impact of the non-linear effects on radio communications, especially under highly disturbed ionosphereic conditions. Experimental work of 'Initial Phase' investigation dealt with the measurement of combination frequencies generated by the high power heating wave and a low power probing wave. Preliminary results of the measurement are presented. In addition to the experimental work, a theoretical feasibility study of the so-called wireless radiation system was made to determine its applicabilitiy to ELF and ULF radio communications. This radiation system is brought about by modulating the ionospheric current system using high-power HF heater. Numerical results of predicted radiated powers are also presented in this report. Author (GRA)

N79-25287# Lincoln Lab., Mass. Inst. of Tech., Lexington.
INFORMATION PROCESSING TECHNIQUES PROGRAM. VOLUME 1: PACKET SPEECH SYSTEMS TECHNOLOGY Semiannual Technical Summary Report, 1 Apr. - 30 Sep. 1978
Bernard Gold and Ernest Stern Sep. 1978 21 p
(Contract F19628-78-C-0002)
(AD-A066249; ESD-TR-78-289-Vol-1) Avail: NTIS HC A02/MF A01 CSCL 17/2

This report describes work performed on the Packet Speech Systems Technology Program sponsored by the Information Processing Techniques Office of the Defense Advanced Research Projects Agency during the period 1 April through 30 September 1978. Author (GRA)

N79-25288# Speech Communication Research Lab., Los Angeles, Calif.
REVIEW OF THE ARPA SUR PROJECT AND SURVEY OF CURRENT TECHNOLOGY IN SPEECH UNDERSTANDING Final Report, 20 Jul. 1977 - 19 Jul. 1978
Wayne A. Lea and June E. Shoup Jan. 1979 162 p refs
(Contract N00014-77-C-0570)
(AD-A066161) Avail: NTIS HC A08/MF A01 CSCL 17/2

The 5 year, nine-contractor ARPA SUR project produced feasibility demonstrations of computer systems that understood spoken sentences related to restricted task domains. This report reviews and evaluates the contributions of that project, including the successful Harpy system developed at Carnegie-Mellon University (CMU) and other less successful but more ambitious systems developed at CMU, Bolt Beranek and Newman, and System Development Corporation. Harpy successfully understood 95% of the sentences spoken, for a task of document retrieval involving a 1000 word vocabulary. Performances of each system are discussed in light of the complexities of the data retrieval or management tasks undertaken by the system. The project was presented in a context of a history of 26 years of work on various forms of speech recognizers. Past and current technology is surveyed, including the currently available commercial products and several development projects. Gaps in current technology are defined and recommendations for filling those gaps are offered. Speech science centers and coordinated projects are suggested as means to advance the technology and relate the previous research to real applications. GRA

N79-25289# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
SHORT PULSE PROPAGATION IN THE SUBMILLIMETER REGION Final Report, 1 Sep. 1977 - 30 Nov. 1978
H. A. Haus 31 Jan. 1979 191 p refs
(Contract DAAG29-77-C-0043)
(AD-A067214; ARO-15323.1-P) Avail: NTIS HC A09/MF A01 CSCL 20/14

The potential of high intensity pulses, in particular so-called zero-pi pulses, is investigated for transmission of submillimeter waves through the atmosphere. In the theoretical part of the paper the inverse scattering method is applied. A numerical investigation of pulse propagation in the presence of loss is made. The report contains many computer plots which aid in the physical understanding of nonlinear propagation. Author (GRA)

N79-25290# Lincoln Lab., Mass. Inst. of Tech., Lexington.
INFORMATION PROCESSING TECHNIQUES PROGRAM. VOLUME 2: WIDEBAND INTEGRATED VOICE/DATA TECHNOLOGY Semiannual Technical Summary Report, 1 Apr. - 30 Sep. 1978
Bernard Gold 30 Sep. 1978 44 p refs
(Contract F19628-78-C-0002; ARPA Order 2929)
(AD-A067355; ESD-TR-78-366) Avail: NTIS HC A03/MF A01 CSCL 17/2

This report describes work performed on the Wideband Integrated Voice/Data Technology program sponsored by the Information Processing Techniques Office of the Defense Advanced Research Projects Agency during the period 1 April through 30 September 1978. GRA

N79-25291# Martin Marietta Aerospace, Orlando, Fla.
HYBRID COMPUTER SIMULATION STUDIES FOR SYSTEM CONTROL AND TRANSMISSION Final Report, Jun. 1978 - Mar. 1979
J. Kenneth Bishop and M. Keith Klukis Mar. 1979 248 p refs
(Contract DCA100-77-C-0061)
(AD-A067362; AD-E100195; OR-15438) Avail: NTIS HC A11/MF A01 CSCL 17/2

This report documents the results of the second 9 months of simulations and studies in support of system control and transmission systems for the Defense Communications Agency. Section 1.0 describes and documents simulations and study results for system control of the Defense Communications System with deployment of future digital subsystems. Section 2.0 describes and documents the hybrid computer simulation of troposcatter and line-of-sight digital transmission systems and support software. Section 3.0 describes the hybrid computer remote terminal support for personnel at the Defense Communications Engineering Center. GRA

N79-25292# Illinois Univ. at Urbana-Champaign, Urbana. Dept. of Electrical Engineering.
EXCITATION OF MODAL FIELDS IN PARALLEL-PLATE TRANSMISSION LINE Final Report, 30 Jun. 1976 - 31 Dec. 1978
R. Mittra and S. W. Lee Feb. 1979 136 p refs
(Grant AF-AFOSR-3066-76; AF Proj. 2301)
(AD-A067230; UIEM-79-4; UILU-ENG-79-2543; AFOSR-79-0430TR) Avail: NTIS HC A07/MF A01 CSCL 20/14

In this report we discuss the problem of source radiation in an open, parallel-plate waveguide of finite width. Such a structure is used as a simulator for testing EMP hardening of large systems such as aircrafts. A conventional approach to expanding the fields in an open waveguide of this type entails the use of the leaky-mode representation. Such a representation is an approximate one and, under certain situations, it is desirable to verify its accuracy. The solution derived in this report is a complete one and can be used to test the leaky mode representation.
Author (GRA)

N79-25293# School of Aerospace Medicine, Brooks AFB, Tex.
ANALYSIS OF A FORTRAN PROGRAM FOR COMPUTING ELECTRIC FIELD DISTRIBUTIONS IN HETEROGENEOUS PENETRABLE NONMAGNETIC BODIES OF ARBITRARY SHAPE THROUGH APPLICATION OF TENSOR GREEN'S FUNCTIONS
J. W. Penn and David K Cohoon Dec. 1978 85 p refs
(AF Proj. 7757)
(AD-A067268; SAM-TR-78-40) Avail: NTIS HC A05/MF A01 CSCL 20/3

An integral equation whose solution is the electromagnetic field induced in a heterogeneous, penetrable, nonmagnetic body--e.g., a biological body--by an external source is derived and approximated by a linear equation for computer implementation. A computer program for carrying out the discrete approximation of the integral equation is described. The use of symmetry groups in saving computer storage is explained. The scattering of a plane wave by a homogeneous ball is analyzed by this program and the results are compared with those produced by a computer program that implements the Mie solution.
Author (GRA)

N79-25294# Mississippi Univ., University.
SIMPLE AND EFFICIENT NUMERICAL TECHNIQUES FOR TREATING BODIES OF REVOLUTION
A. W. Glisson and D. R. Wilton Griffiss AFB, N.Y. RADC Mar. 1979 137 p refs
(Contract F30602-78-C-0120)
(AD-A067361; RADC-TR-79-22) Avail: NTIS HC A07/MF A01 CSCL 20/3

Integral equations are derived and a numerical procedure is developed to treat scattering by bodies of revolution. Both dielectric and metallic scatterers are considered and the metallic scatterers may be either open or closed. The program is validated by comparing to spheres and finite cylinders for the dielectric case. In the conducting case, a cone-spheres and an open-ended cylinder are treated. It is found that the problem of instability noted in other formulations for the open-ended cylinder problem does not appear in the present formulation. A brief description of the program and a program listing are also given.
Author (GRA)

N79-25295# Raytheon Co., Sudbury, Mass. Equipment Div.
INVESTIGATION OF SPECIAL TECHNIQUES RELATED TO SATELLITE COMMUNICATIONS. VOLUME 2: TASK 2, mm WAVE TECHNOLOGY Final Report
A. A. Castro and J. F. Healy 25 Aug. 1978 108 p refs
(Contract DCA100-77-C-0059)
(AD-A067292; AD-E100198; ER-78-4272) Avail: NTIS HC A06/MF A01 CSCL 22/2

This report described the results of developing a mm Wave Technology baseline for satellite communication systems. This baseline is applicable to a deployment frame from 10 to 15 years and covers the satellite communications bands from 20 to 100 GHz. To project the technology to such a long time span, the state-of-the-art of the mm Wave subsystems, for both the ground and space segments of satellite communication systems, were surveyed. Their limitations were investigated and, where applicable, extrapolations were made to the time frame of interest.
Author (GRA)

N79-25296# Grenoble Univ. (France). Centre d'Etude des Phenomenes Aleatoires et Geophysiques.
[ACTIVITIES OF THE CENTRE D'ETUDE DES PHENOMENES ALEATOIRES ET GEOPHYSIQUES] Semiannual Report
J. L. Lacoume 18 Jul. 1977 13 p In FRENCH
(CEPHAG-34/77; SAR-1) Avail: NTIS HC A02/MF A01

Several problems in signal processing and signal analysis are described. Mathematical and statistical methods are developed; progress is described. Applications to antenna theory and radio echo processing are given.
Author (ESA)

N79-25297# Grenoble Univ. (France). Centre d'Etude des Phenomenes Aleatoires et Geophysiques.
[ACTIVITIES OF THE CENTRE D'ETUDE DES PHENOMENES ALEATOIRES ET GEOPHYSIQUES] Semiannual Report
J. L. Lacoume 21 Dec. 1977 14 p In FRENCH
(CEPHAG-53/77; SAR-2) Avail: NTIS HC A02/MF A01

Wave propagation in a scattering medium was analyzed. Many ways of processing a distorted signal in order to recover its original form are described, as are coding systems. Analyses are given of reverberation and echo problems.
Author (ESA)

N79-25298# Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).
ONBOARD MESSAGE SWITCHING AND SIGNAL PROCESSING. VOLUME 1: SUMMARY
P. Amadesi, V. Castellani, G. Cordaro, C. DallOlio, D. DiPino, L. Moreno, F. Pattini, M. Pent, Giussto P. Porzio, R. Preti et al Paris ESA Jul. 1978 64 p Prepared jointly with Politec. di Torino 2 Vol.
(Contract ESTEC-2872/76-NL-SK(SC))
(CSELT-RI-78-07-308-Vol-1; ESA-CR(P)-1138-Vol-1) Avail: NTIS HC A04/MF A01

The use of a regenerative onboard repeater in a satellite communication link was closely examined and is discussed in detail. Results show that a differential modulator is suitable for the up-link and a more conventional CPSK, operating in continuous mode can be used for the down-link. Hardware implementation is discussed. A satellite regenerative repeater can be implemented using well known technologies, in a simple and reliable way. The increase in size, mass, and power consumption is compared to a nonregenerative repeater. Two distinctive features entail a number of definite advantages; there is complete separation between up and down links and the onboard baseband signal is readily available.
Author (ESA)

N79-25299# Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).
ONBOARD MESSAGE SWITCHING AND SIGNAL PROCESSING. VOLUME 2
P. Amadesi, V. Castellani, G. Cordaro, C. DallOlio, D. DiPino, L. Moreno, F. Pattini, M. Pent, Giusto P. Porzio, R. Preti et al Paris ESA Jul. 1978 481 p refs Prepared jointly with Politec. di Torino 2 Vol.
(Contract ESTEC-2872/76-NL-AK(SC))
(CSELT-RI-78-07-302-Vol-2; ESA-CR(P)-1138-Vol-2) Avail: NTIS HC A21/MF A01

The use of a regenerative onboard repeater in a satellite communication link was closely examined and is discussed in detail. Differential modulator is suitable for the up-link and a more conventional CPSK, operating in a continuous mode can be used for the down-link. Hardware implementation is discussed. A satellite regenerative repeater can be implemented, using well known technologies a simple and reliable way. The increase in size, mass, and power consumption is compared to a nonregenerative repeater. Two distinctive features entail a number of definite advantages; there is complete separation between up and down links and the onboard baseband signal is readily available.
Author (ESA)

N79-25300# Sener, S.A., Madrid (Spain).
CONFIGURATION DESIGN STUDY OF AN OPTICAL SCANNING MECHANISM ASSEMBLY (OSMA)
L. B. FernandezSainz Paris Paris Oct. 1978 172 p

(Contract ESTEC-3444/77)
(SENER-PS-1010; ESA-CR(P)-1140) Avail: NTIS HC A08/MF A01

A feasibility study for an optical scanning mechanism assembly (OSMA) was carried out in order to select the most promising design. Two configurations were considered. Components which need development work and areas of technological difficulty were also identified. Error, stress, thermal, and vibration analyses are given together with weight estimates. A complete set of drawings dimensioned at the subassembly level is available. Author (ESA)

N79-25301# National Technical Information Service, Springfield, Va.
ANTENNA ARRAYS, VOLUME 3. CITATIONS FROM THE NTIS DATA BASE Progress Report, Mar. 1976 - Mar. 1977
William E. Reed Apr. 1979 257 p
(NTIS/PS-79/0317/2) Avail: NTIS HC $28.00/MF $28.00 CSCL 09E

Federally-sponsored research reports are cited for the use of antenna arrays in the fields of radar, communications, radio astronomy, navigation, electronic countermeasures, and spacecraft. Topics include design, antenna radiation patterns, mathematical models, and performance. This updated bibliography contains 250 abstracts, none of which are new entries to the previous edition. GRA

N79-25302# National Technical Information Service, Springfield, Va.
ANTENNA ARRAYS, VOLUME 4. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1978 - Mar. 1979
William E. Reed Apr. 1979 90 p Supersedes NTIS/PS-78/0310; NTIS/PS-77/0262; NTIS/PS-76/0310; NTIS/PS-75/302
(NTIS/PS-79/0318/0; NTIS/PS-78/0310; NTIS/PS-77/0262; NTIS/PS-76/0310; NTIS/PS-75/302) Avail: NTIS HC $28.00/MF $28.00 CSCL 09E

Federally-sponsored research reports are cited for the use of antenna arrays in the fields of radar, communications, radio astronomy, navigation, electronic countermeasures, and spacecraft. Topics include design, antenna radiation patterns, mathematical models, and performance. Phased array studies are excluded. This updated bibliography contains 83 abstracts, 75 of which are new entries to the previous edition. GRA

N79-25303# National Technical Information Service, Springfield, Va.
ANTENNA ARRAYS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Mar. 1979
William E. Reed Apr. 1979 226 p Supersedes NTIS/PS-78/0311; NTIS/PS-77/0263; NTIS/PS-76/0311
(NTIS/PS-79/0319/8; NTIS/PS-78/0311; NTIS/PS-77/0263; NTIS/PS-76/0311) Avail: NTIS HC $28.00/MF $28.00 CSCL 09E

Worldwide research on antenna arrays was cited. Topics included design, propagation, antenna radiation patterns, mathematical analysis, signal processing, and interference rejection. Phased array studies were excluded. GRA

N79-25304# Bureau of Radiological Health, Rockville, Md. Div. of Electronic Products.
MEASUREMENTS OF ELECTROMAGNETIC FIELDS IN THE CLOSE PROXIMITY OF CB ANTENNAS Final Report
Paul S. Ruggera Jan. 1979 35 p refs
(PB-292404/1; DHEW/PUB/FDA-79/8080; FRA/BRH-79/65) Avail: NTIS HC A03/MF A01 CSCL 09E

Comparisons were made between the field distributions for different antenna designs and different mounting locations. The measured emission levels at 5 cm from all of the antennas tested exceeded either 200 V/m or 0.5 A/m or both at some point along the vertical height of the antenna. Levels of this magnitude persisted for some of the antennas at a 12 cm separation distance. GRA

N79-25305# National Bureau of Standards, Washington, D. C.
COMMUNICATION SYSTEMS GUIDE
Winston W. Scott, Jr. Jan. 1979 39 p refs Sponsored in part by the Natl. Inst. of Law Enforcement and Criminal Justice, Washington, D. C.
(PB-292301/9; NBS-SP-480-12; LC-78-600150) Avail: NTIS HC A03/MF A01 CSCL 17B

Telecommunication was discussed along with principal components, cost considerations, and purchase of communications equipment. GRA

N79-25095*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
RECOVERING THE SPECTRUM OF A NARROW-BAND PROCESS FROM SYNCOPATED SAMPLES
P. H. Milenkovic *In its* The Deep Space Network 15 Jun. 1979 p 47-50 refs (For primary document see N79-25088 16-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

N79-25097*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SOME EFFECTS OF QUANTIZATION ON A NOISELESS PHASE-LOCKED LOOP
C. A. Greenhall *In its* The Deep Space Network 15 Jun. 1979 p 58-66 refs (For primary document see N79-25088 16-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

N79-25099*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ANTENNA FEEDHORN SOFTWARE UPGRADE
P. D. Potter *In its* The Deep Space Network 15 Jun. 1979 p 75-84 refs (For primary document see N79-25088 16-12)
Avail: NTIS HC A11/MF A01 CSCL 20N

N79-25100*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
FEASIBILITY OF INERTIALESS CONSCAN UTILIZING MODIFIED DSN FEEDSYSTEMS
P. D. Potter *In its* The Deep Space Network 15 Jun. 1979 p 85-93 refs (For primary document see N79-25088 16-12)
Avail: NTIS HC A11/MF A01 CSCL 17I

N79-25101*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COSTAS LOOP DEMODULATION OF SUPPRESSED CARRIER BPSK SIGNALS IN THE DSN ENVIRONMENT: EXPERIMENTAL RESULTS OBTAINED AT TDL
R. Reasoner *In its* The Deep Space Network 15 Jun. 1979 p 94-104 refs (For primary document see N79-25088 16-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

N79-25105*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CARRIER TRACKING LOOP PERFORMANCE IN THE PRESENCE OF STRONG CW INTERFERENCE
B. K. Levitt *In its* The Deep Space Network 17 Jun. 1979 p 130-137 refs (For primary document see N79-25088 16-12)
Avail: NTIS HC A11/MF A01 CSCL 20N

N79-25106*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSS 13 ANTENNA MONITOR SYSTEM
B. Siev and D. Bayergo *In its* The Deep Space Network 15 Jun. 1979 p 138-140 (For primary document see N79-25088 16-12)
Avail: NTIS HC A11/MF A01 CSCL 09C

N79-25112*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MICROWAVE TIME DELAYS IN THE DSN 34- AND 64-METER ANTENNAS
R. Hartop *In its* The Deep Space Network 15 Jun. 1979 p 183-185 (For primary document see N79-25088 16-12)
Avail: NTIS HC A11/MF A01 CSCL 20N

N79-25113*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ASSESSMENT OF 20 kW S-BAND TRANSMITTER

R. Dickinson and H. Hansen *In its* The Deep Space Network 15 Jun. 1979 p 186-192 refs (For primary document see N79-25088 16-12)
Avail: NTIS HC A11/MF A01 CSCL 17B

N79-25114*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A CIRCUIT MODEL FOR ELECTROMAGNETIC PROPERTIES OF WAVEGUIDE ARCS
J. C. Yen *In its* The Deep Space Network 15 Jun. 1979 p 193-195 refs (For primary document see N79-25088 16-12)
Avail: NTIS HC A11/MF A01 CSCL 09C

N79-25982# Plessey Radar Ltd., Addlestone (England).
TACTICAL RADAR FOR AIR DEFENSE
R. N. Oldfield *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 16 p (For primary document see N79-25977 16-99)
Avail: NTIS HC A16/MF A01

N79-25986# Hughes Aircraft Co., Fullerton, Calif.
THE ROLE OF ADVANCED TECHNOLOGY IN TDMA SYSTEMS
Frank Amoroso and John D. Olsen *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 23 p refs (For primary document see N79-25977 16-99)
(Contracts DAAB07-76-C-1750; F19628-75-C-0205)
Avail: NTIS HC A16/MF A01

N79-25987# Rome Air Development Center, Griffiss AFB, N.Y.
MULTI-FUNCTION COMMUNICATIONS AND TACTICAL DATA LINKS
Henry J. Bush *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 11 p refs (For primary document see N79-25977 16-99)
Avail: NTIS HC A16/MF A01

N79-25988# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. Department of Electrical Engineering.
INTERACTION OF ANTENNA ARRAYS AND MODEMS IN TACTICAL LINKS
Stanley R. Robinson, Edward Raska, Jr., and Jurgen O. Gobien (Rome Air Development Center, Griffiss AFB, N. Y.) *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 11 p refs (For primary document see N79-25977 16-99)
Avail: NTIS HC A16/MF A01

N79-26001# Plessey Radar Ltd., Addlestone (England).
PROJECT WAVELL
R. J. Fairchild *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 10 p (For primary document see N79-25977 16-99)
Avail: NTIS HC A16/MF A01

N79-26002# RCA Government Systems Div., Moorestown, N. J. Advanced Programs Development.
MOBILE TACTICAL C TO 3RD POWER SYSTEMS
David Shore *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 5 p (For primary document see N79-25977 16-99)
Avail: NTIS HC A16/MF A01

N79-26003# Army Avionics Research and Development Activity, Fort Monmouth, N. J.
AIRBORNE DATA TRANSFER SYSTEM (ADTS)
Charles J. Stuppi, Jr. and Lockwood W. Reed *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 17 p (For primary document see N79-25977 16-99)
Avail: NTIS HC A16/MF A01

N79-26004# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
PRECISION LOCATION STRIKE SYSTEM NEAR-REAL-TIME C TO THE 3RD POWER I FOR THE TACTICAL BATTLEFIELD
James T. Bowen *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 6 p (For primary document see N79-25977 16-99)
Avail: NTIS HC A16/MF A01

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N79-25306 Rensselaer Polytechnic Inst., Troy, N. Y.
NEUTRON RADIATION EFFECTS IN GaAs MS AND MIS SCHOTTKY DIODES Ph.D. Thesis
S. Ashok 1978 170 p
Avail: Univ. Microfilms Order No. 7913071

The electrical characteristics of GaAs metal-semiconductor (MS) and metal-insulator-semiconductor (MIS) Schottky barrier diodes were investigated before and after fast-neutron irradiation. From current-voltage and capacitance-voltage data obtained over a wide temperature range, the mechanisms of barrier formation and current flow, as well as radiation effects on the electrical parameters are ascertained. Dissert. Abstr.

N79-25307 Illinois Univ. at Urbana-Champaign, Urbana.
THE DESIGN OF FAULT TOLERANT INTERCONNECTION NETWORKS Ph.D. Thesis
William Edward Davidson 1978 128 p
Avail: Univ. Microfilms Order No. 7913420

The size and complexity of current computing systems forced a trend towards modularization. This allows reduction of large design and debugging problems to that of a set of smaller, more manageable problems. Modularization not only aids in designability but helps reduce obsolescence. Modules can be replaced to improve system performance without having to redesign the complete system. A highly reliable form of interconnections among modules is required. It should be simple, expandable, controllable, testable and in short more reliable than the system components. A design technique for such an interconnection network is presented. The design parameters are: connectivity requirements, module complexity and concurrent job capability. The result is a network which not only has the above traits, but is custom designed for the system. Dissert. Abstr.

N79-25308 Illinois Univ. at Urbana-Champaign, Urbana.
APPLICATION OF EXACT STEADY-STATE EQUIVALENT CIRCUIT MODEL TO ZINC-DOPED SILICON P/N JUNCTIONS UNDER FORWARD BIAS Ph.D. Thesis
Ching Ho Chan 1978 132 p
Avail: Univ. Microfilms Order No. 7913406

One-dimensional characteristics of a two-terminal semiconductor device is modeled by distributed equivalent circuits. The model is generalized to include Shockley-Read-Hall recombination centers of an arbitrary number of energy levels. It is then applied to study the double acceptor zinc centers in silicon. The devices used in the study are zinc doped p/n junction diodes. The electrical properties of the diodes such as the spatial variation of carrier densities, electric field, net charge density, recombination rate and current densities were studied in detail at different injection levels. The zinc population and the relative importance of recombination at each zinc energy level is explained. The majority and minority carrier lifetimes are also studied. Factors which affect carrier lifetimes are pointed out and illustrated. The forward I-V characteristics of the p/n diodes calculated from the model are compared with experiment. Dissert. Abstr.

N79-25309*# National Bureau of Standards, Boulder, Colo.
THE ROLE OF SUPERCONDUCTIVITY IN THE SPACE PROGRAM: AN ASSESSMENT OF PRESENT CAPABILITIES AND FUTURE POTENTIAL
D. B. Sullivan, ed. May 1978 164 p refs
(NASA Order A-437018(JM))
(NASA-CR-158701; NBSIR-78-885) Avail: NTIS HC A12/MF A01 CSCL 09C

Technical subject areas discussed include: (1) high field magnets; (2) magnetometers; (3) digital electronics; (4) high frequency detectors; (5) instruments related to gravitational studies; and (6) ultra high Q cavities. Applications of superconduc-

tivity which are of potential interest to NASA were identified. S.E.S.

N79-25310*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ANALYTICAL MODELING OF THE DYNAMICS OF BRUSHLESS dc MOTORS FOR AEROSPACE APPLICATIONS: A CONCEPTUAL FRAMEWORK
Nabeel A. O. Demerdash 18 Aug. 1976 102 p refs
(NASA-TM-80445; IN-76-EG-18; JSC-11552) Avail: NTIS HC A06/MF A01 CSCL 09A

The modes of operation of the brushless d.c. machine and its corresponding characteristics (current flow, torque-position, etc.) are presented. The foundations and basic principles on which the preliminary numerical model is based, are discussed. M.M.M.

N79-25311*# National Aeronautics and Space Administration. Pasadena Office, Calif.
SCHOTTKY BARRIER CELL AND METHOD OF FABRICATING IT Patent Application
Richard J. Stirn (JPL) and Yea-Chuan M. Yeh, inventors (to NASA) (JPL) Filed 29 Sep. 1977 25 p Sponsored by NASA
(NASA-Case-NPO-13689A; US-Patent-Appl-SN-837513) Avail: NTIS HC A02/MF A01 CSCL 09A

A low cost Schottky barrier type solar cell is described. The prior active layer substrate is replaced with an inexpensive semiconductor polycrystalline substrate on which the active layer is grown, eliminating the need for a single crystal wafer. The methods of forming native and nonnative interfacial oxide layers is presented. M.M.M.

N79-25312*# TRW Defense and Space Systems Group, Redondo Beach, Calif.
EFFECTS OF ARCING DUE TO SPACECRAFT CHARGING ON SPACECRAFT SURVIVAL Final Report, May - Nov. 1978
A. Rosen, N. L. Sanders, J. M. Ellen, Jr., and G. T. Inouye 14 Nov. 1978 172 p refs
(Contract NAS3-21363)
(NASA-CR-159593; TRW-33631-6006-RU-00) Avail: NTIS HC A08/MF A01 CSCL 09C

A quantitative assessment of the hazard associated with spacecraft charging and arcing on spacecraft systems is presented. A literature survey on arc discharge thresholds and characteristics was done and gaps in the data and requirements for additional experiments were identified. Calculations of coupling of arc discharges into typical spacecraft systems were made and the susceptibility of typical spacecraft to disruption by arc discharges was investigated. Design guidelines and recommended practices to reduce or eliminate the threat of malfunction and failures due to spacecraft charging/arcing were summarized. R.E.S.

N79-25313*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
LIGHTNING DISCHARGE IDENTIFICATION SYSTEM Patent Application
Carl L. Lennon, inventor (to NASA) Filed 30 May 1979 7 p
(NASA-Case-KSC-11099-1; US-Patent-Appl-SN-043945) Avail: NTIS HC A02/MF A01 CSCL 09A

A system for differentiating between cloud to cloud and cloud to ground lightning discharges was developed which includes an electric field antenna that senses the rate of change of an electric field produced by a lightning discharge. When the signal produced by the electric field exceeds a predetermined threshold, it is fed to a coincidence detector. A VHF antenna is also provided. When signals from the electric field antenna and the VHF antenna appear at the coincidence detector simultaneously, such indicates that there is a cloud to cloud lightning discharge; whereas, when there is not a signal produced on the VHF antenna simultaneously with a signal produced by the field sensor, then a strike indicator connected to the coincidence detector indicates a cloud to ground lightning discharge. NASA

N79-25314*# National Aeronautics and Space Administration. Pasadena Office, Calif.
A GENERAL LOGIC STRUCTURE FOR CUSTOM LSI CIRCUITS Patent Application
Michael W. Sievers, inventor (to NASA) (JPL) Filed 1 Jun. 1979 27 p
(Contract NAS7-100)
(NASA-Case-NPO-14410-1; US-Patent-Appl-SN-044429) Avail: NTIS HC A03/MF A01 CSCL 09C

A general logic structure is described for custom large scale integration (LSI) circuit substrates. To form a NOR gate, a conduction column is connected to a pull-up resistor and a diffused conductor segment is positioned to cross an implicant row and connect a diffusion row to the conduction column. Conduction column and implicant row segments are formed by overlay masks which define cuts and contacts on a basic mask set defining the general logic structure. These overlay masks also define the diffused conductor segments. By interconnecting the various rows, columns, pull-up resistors, and diffused conductor segments within the structure, a plurality of NOR gates can be created to form a predetermined NOR gate logic array. Thus, overlay masks are utilized to program the basic general logic structure mask set to provide easily manufactured, high density, custom logic circuits. NASA

N79-25315*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
IMPROVED POWER FACTOR CONTROL SYSTEM FOR ac INDUCTION MOTORS Patent Application
Frank J. Nola, inventor (to NASA) Filed 1 Jun. 1979 21 p
(NASA-Case-MFS-23988-1; US-Patent-Appl-SN-044431) Avail: NTIS HC A02/MF A01 CSCL 09C

A power control circuit for an induction motor was developed. A servo loop was used to control power input by controlling the power factor of motor operation. The power factor was then measured by summing the voltage and current derived square wave signals. NASA

N79-25316*# Mississippi State Univ., State College. Dept. of Electrical Engineering.
DESIGN, FABRICATION, AND EVALUATION OF CHARGE-COUPLED DEVICES WITH ALUMINUM-ANODIZED-ALUMINUM GATES Interim Report
J. D. Gassaway and W. H. Causey, Jr. Feb. 1977 64 p refs
(Contract NAS8-26749)
(NASA-CR-150218) Avail: NTIS HC A04/MF A01 CSCL 09C

A 4-phase, 49 1/2 bit CCD shift register was designed and fabricated using two levels of aluminum metallization with anodic Al2O3 insulation separating the layers. Test circuitry was also designed and constructed. A numerical analysis of an MOS-RC transmission line was made and results are given to characterize performance for various conductivities. The electrical design of the CCD included a low-noise dual-gate input and a balanced floating diffusion output circuit. Metallization was accomplished both by low voltage DC sputtering and thermal evaporation. The audization was according to published procedures using a buffered tartaric acid bath. Approximately 20 wafers were processed with 50 complete chips per wafer. All devices failed by shorting between the metal levels at some point. Experimental procedures eliminated temperature effects from sintering and drying, anodic oxide thickness, edge effects, photoresist stripping procedures, and metallization techniques as the primary causes of failure. It was believed from a study of SEM images that protuberances (hillocks) grow up from the first level metal through the oxide either causing a direct short or producing a weak, highly stressed insulation point which fails at low voltage. The cause of these hillocks is unknown; however, they have been observed to grow during temperature excursions to 470 C. A.R.H.

N79-25317*# RCA Labs., Princeton, N. J.
DESIGN, PROCESSING, AND TESTING OF LSI ARRAYS FOR SPACE STATION Final Report, 30 Jun. 1969 - 14 Jul. 1976
A. C. Ipri Aug. 1976 61 p refs
(Contract NAS12-2207)
(NASA-CR-150213; PRRL-76-CR-42) Avail: NTIS HC A04/MF A01 CSCL 09C

The applicability of a particular process for the fabrication of large scale integrated circuits is described. Test arrays were designed, built, and tested, and then utilized. A set of optimum dimensions for LSI arrays was generated. The arrays were applied

to yield improvement through process innovation, and additional applications were suggested in the areas of yield prediction, yield modeling, and process reliability. M.M.M.

N79-25318*# RCA Applied Computer Systems Lab., Camden, N. J.
CMOS ARRAY DESIGN AUTOMATION TECHNIQUES Final Report
T. Lombardi and A. Feller Dec. 1976 36 p refs
(Contract NAS12-2233)
(NASA-CR-150221) Avail: NTIS HC A03/MF A01 CSCL 09C

The design considerations and the circuit development for a 4096-bit CMOS SOS ROM chip, the ATL078 are described. Organization of the ATL078 is 512 words by 8 bits. The ROM was designed to be programmable either at the metal mask level or by a directed laser beam after processing. The development of a 4K CMOS SOS ROM fills a void left by available ROM chip types, and makes the design of a totally major high speed system more realizable. M.M.M.

N79-25319*# Mississippi State Univ., Mississippi State. Dept. of Electrical Engineering.
CCD RESEARCH
J. D. Gassaway 1 Jul. 1976 55 p refs
(Contract NAS8-26749)
(NASA-CR-150219) Avail: NTIS HC A04/MF A01 CSCL 09C

The fundamental problems encountered in designing, fabricating, and applying CCD's are reviewed. Investigations are described and results and conclusions are given for the following: (1) the development of design analyses employing computer aided techniques and their application to the design of a grapped structure; (2) the role of CCD's in applications to electronic functions, in particular, signal processing; (3) extending the CCD to silicon films on sapphire (SOS); and (4) all aluminum transfer structure with low noise input-output circuits. Related work on CCD imaging devices is summarized. A.R.H.

N79-25320# Vought Corp. Advanced Technology Center, Inc., Dallas, Tex.
DEVELOPMENT OF PVF2 NOISE-CANCELLING MICROPHONE Final Technical Report, Jul. 1977 - Jan. 1979
A. J. Brouns Mar. 1979 53 p refs
(Contract DAAB07-77-C-0162)
(AD-A067276; ATC-B-93100/9CR-4; CORADCOM-77-0162-f) Avail: NTIS HC A04/MF A01 CSCL 09/1

This report describes the theory, development, and performance of a noise-cancelling microphone for military use. The generating element is a bimorph annulus, constructed by bonding plastic films of piezoelectric PVF2 (polyvinlidene fluoride) to a central shim of aluminum. The aluminum shim controls the stiffness of the bimorph so that wide-bandwidth operation is obtained over a temperature range of -51 C to +71 C. The fundamental resonance frequency is above the speech frequency range so that damping structures are not required. The microphone includes a preamplifier. The microphone assembly is similar to that of a previously developed piezoceramic microphone. The sensitivity of the PVF2 bimorph is 10 dB less than that of the piezoceramic bimorph. The PVF2 film has a deposited aluminum electrode which was found to require careful handling to avoid loss of electrical continuity. Except for considerations of the integrity of the PVF2 electrode, the PVF2 material provides a rugged, highly-linear, noise-cancelling microphone. Author (GRA)

N79-25321# Microwave Associates, Inc., Burlington, Mass.
RELIABILITY STUDY OF HIGH EFFICIENCY GaAs IMPATT DEVICES Final Technical Report, Sep. 1976 - Jun. 1978
John L. Heaton Griffiss AFB, N. Y. RADC Jan. 1979 104 p refs
(Contract F30602-76-C-0409; AF Proj. 2338)
(AD-A067223; RADC-TR-78-203) Avail: NTIS HC A06/MF A01 CSCL 09/1

The reliability of low-high-low profile gallium arsenide IMPATT diodes has been studied. The devices were fabricated from vapor phase grown epitaxial gallium arsenide using sputtered platinum Schottky junctions and plated heat sink contruction. Various screening methods have been evaluated for use in burn-in, and 75 C case DC burn-in at rated power dissipation selected as the best compromise. Long-term operation tests have established a minimum MTBF at 90% confidence of 41,000 hours. RF storage step stress tests have revealed a potential failure mechanism involving separation of the metallization layers. An improved metallization system has been established eliminating this mechanism. Various additional tests have demonstrated the immunity of these IMPATTs to damage from on-off switching transients, load mismatch and bias voltage transients.
Author (GRA)

N79-25322# Hughes Aircraft Co., Torrance, Calif. Electron Dynamics Div.
PERMANENT MMAGNET STUDY FOR HIGH AVERAGE POWER TWTS Final Technical Report, May 1977 - Sep. 1978
W. A. Harman, R. S. Hollister, and J. O. Tillery Griffiss AFB, N. Y. RADC Feb. 1979 181 p refs
(Contract F30602-77-C-0109; AF Proj. 5573)
(AD-A067319; EDD-W-07407-F; RADC-TR-78-288) Avail: NTIS HC A09/MF A01 CSCL 09/1

The average power capability of permanent magnet focused high power linear beam tubes is typically limited by beam interception resulting from beam defocusing with large signals. This is prevented in solenoid focused tubes by using fields substantially higher than the Brillouin value. This method of confining the beam is only practical in periodic magnetic geometries for relatively low values of beam perveance. Size and weight advantages of permanent magnets over electromagnets and their accompanying power supplies make it advantageous to find ways for increasing the average power handling capability of tubes with permanent magnet configurations. In instances where lower perveance beams continue to interact at acceptable RF levels, substantial improvements in beam defocusing are indicated, but at the penalty of higher operating voltages for similar power levels. A detailed thermal analysis of a typical high power traveling wave tube (TWT) indicates areas where additional thermal capability might be achieved. A system life cycle analysis on a solenoid focused tube indicates a small percentage of failures due to focusing problems, however, failure rates associated with the tube alone would be higher. A design is presented for a high average power S-Band TWT using concepts developed during the study. GRA

N79-25323# Aerospace Corp., El Segundo, Calif. Electronics Research Lab.
STATE OF ART OF LaB6 RESEARCH, 1978 Interim Report
Helmut Kanter, Norris M. Mendoza, and Armond B. Chase 12 Mar. 1979 44 p refs
(Contract F04701-78-C-0079)
(AD-A066702; TR-0079(4930-05)-1; SAMSO-TR-79-22) Avail: NTIS HC A03/MF A01 CSCL 09/1

An overview of present understanding of physics in LaB6 is given: Band-structure in bulk and on surface, phonon modes, emission characteristics, surface stability and fabrication methods are touched upon. No attempt at an in-depth correlation of research results has been made, the report is rather a guide to the most recent literature which has appeared on this subject.
Author (GRA)

N79-25324# Cober Electronics, Inc., Stamford, Conn.
HIGH VOLTAGE NANOSECOND PULSE GENERATOR Triannual Interim Report, 1 Sep. 1977 - 30 Jun. 1978
J. Bajda and C. Zavales Nov. 1978 26 p
(Contract DAAB07-77-C-2641; DA Proj. 1L7-62705-AH-94)
(AD-A066803; DELET-TR-77-2641-3; IR-3) Avail: NTIS HC A02/MF A01 CSCL 09/5

This report describes work performed to develop a set of high voltage nanosecond pulse generators. The objective of the development is a set of pulse generators of small volume, low weight, and high efficiency. Testing of the power supply and modulator for Task A Pulse Generator, operating either single pulse of 15 Hz at a pulsewidth of 125 ns, pulse voltage of 30 kV, and pulse current of 1200 amps, has been proceeding. The power supply and modulator were integrated and operated at an intermediate level of 10 kV. The modulator was tested at 30 kV. Preliminary tests on a SCR-magnetic modulator for

Task B Pulse Generator, providing a 5 kV, 4 A, 100 ns pulse to the load, were conducted. In addition, a solid state pulse generator providing a 16 kV, 0.5 amp, 6 microsec pulse to a laser load was designed, built and tested. GRA

N79-25325# Watkins-Johnson Co., Palo Alto, Calif.
LOW NOISE EBS JAMMER Triannual Report, 28 Jul. 1978 - 30 Nov. 1978
Douglas B. Clark and John B. Rettig Mar. 1979 39 p refs
(Contract DAAB07-78-C-2958; DA Proj. 1L1-62705-AH-94)
(AD-A066576; WJ-22-4142R1; DELET-78-2958-1) Avail: NTIS HC A03/MF A01 CSCL 09/1

The objective of this program is to reduce the output power level of spurious noise signals, intermodulation (IM) products and harmonic distortion generated by deflection modulated electron beam semiconductor (EBS) amplifiers. Work accomplished during the reporting period included identification and theoretical investigation of causes of nonlinearity and measurements of linearity, noise and distortion of existing EBS amplifiers. Author (GRA)

N79-25326# Varian Associates, Palo Alto, Calif. Central Research Lab.
INDIUM PHOSPHIDE GUNN DEVICES (26-60 GHz) Interim Report, 1 Jan. 1978 - 30 Jun. 1978
J. D. Crowley, S. B. Hyder, B. R. Cairns, and F. B. Fank 27 Jul. 1978 69 p refs
(Contract N00123-77-C-0459)
(AD-A066528; IR-2) Avail: NTIS HC A04/MF A01 CSCL 09/5

The research and development program described in this interim report is directed towards the development of InP materials and devices for low noise, broad bandwidth amplifier operation in the 26.5 to 40.0 GHz and the 40.0 to 60.0 GHz bands. The application of InP for CW transferred electron oscillators and amplifiers in the millimeter wave range provides significant performance improvements over the more widely utilized GaAs devices. In particular, InP is a superior material in several respects. It has a current peak-to-valley ratio of 3.5 as opposed to 2.5 for GaAs. This, in theory will provide higher oscillator conversion efficiencies. In addition, the peak-to-valley degrades less rapidly with temperature than GaAs and the thermal conductivity is greater, thus favoring CW operation. Due to the high effective transit velocity (1.3 x 10 to the 7th power cm/sec) and fast intervalley scattering, longer active regions and higher ultimate frequency limitations should favor InP for millimeter wave applications. Finally, InP reflection amplifiers have demonstrated extremely low noise figures (as low as 7.5 dB), which have been attributed to the lower ratio of electron diffusion to mobility in this material. GRA

N79-25327# United Technologies Research Center, East Hartford, Conn.
APPLICATION OF THE PSK DIODE-CORRELATOR FOR PROGRAMMABLE FREQUENCY FILTERING Final Report, 1 Oct. 1976 - 28 Apr. 1978
T. W. Grudkowski and T. M. Reeder 28 Apr. 1978 88 p refs
(Contract N00173-76-C-0373)
(AD-A066752; UTRC/R78-922667-18) Avail: NTIS HC A04/MF A01 CSCL 09/5

This report describes an experimental and theoretical study of nonlinear tapped delay lines for use as an electronically programmable amplitude and phase weighted transversal filter. The Surface Acoustic Wave (SAW) delay line device studied here, which is called the Programmable Frequency Filter Module (PFFM), is a hybrid, integrated circuit device which utilizes SAW taped delay lines and attached microelectronic diode and resistor arrays. The PFFM is based on the UTRC PSK Diode Correlator which underwent basic development as a 126 tap Phase Shift Key (PSK) signal encoder and correlator under NESC Contract N00014-75-C-0978. While the signal processing capabilities of the single acoustic channel PSK Diode Correlator rely on discrete tap programming in 0 and 180 degree relative phase increments, the dual acoustic channel PFFM described here utilizes continuous tap programming in both amplitude and phase. Each acoustic channel of the device consists of a P diode-tapped signal processing region and two input transducer ports. The input signal and CW reference voltages are applied to the input ports at center frequency f(1) and f(2), respectively. A low power, wide bandwidth nonlinear mixing process occurs at each diode tap, and the difference frequency signals from all taps are summed at a common electrode comprising the filter output port. Rapid tap amplitude an biphase coding is achieved by controlling magnitude and polarity applied to the diode mixer located at each delay line tapping transducer. GRA

N79-25328# North Carolina Univ. at Chapel Hill. Labs. of Chemistry.
AN X-RAY PHOTOELECTRON SPECTROSCOPIC STUDY OF MULTILAYERS OF AN ELECTROACTIVE FERROCENE DERIVATIVE ATTACHED TO PLATINUM AND GOLD ELECTRODES
Alan B. Fischer, Mark S. Wrighton, M. Umana, and Royce W. Murray 5 Mar. 1979 27 p refs
(Contract N00014-76-C-0817)
(AD-A066631; TR-8) Avail: NTIS HC A03/MF A01 CSCL 09/1

Pretreated (anodized) Pt and Au electrode surfaces derivatized with (1,1:ferrocenediyl)dichlorosilane have been analyzed by X-ray photoelectron spectroscopy (XPES). The derivatized surfaces exhibit Fe 2p3/2 bands with binding energies consistent with ferrocene iron and with large companion satellite peaks. Using a layer model, relative Fe 2p3/2 and electrode substrate intensities (Au or Pt) can be correlated with ferrocene coverage measured by cyclic voltammetry. The results indicate that electrochemical charge transfer can occur through ferrocene/silane layers of thicknesses exceeding 100 Angstrom. Author (GRA)

N79-25329# Naval Postgraduate School, Monterey, Calif.
INVESTIGATION OF ELECTRODE MATERIALS FOR LOW FREQUENCY ELECTRIC ANTENNAS IN SEA WATER M.S. Thesis
Lawrence Charles Dearth Dec. 1978 90 p refs
(AD-A066366) Avail: NTIS HC A05/MF A01 CSCL 09/5

This paper describes and gives the results of an experiment to measure the D.C. and ULF (0.1 to 1 Hz) relative impedance in sea water of several materials considered as possible electrodes for a submerged electric dipole antenna. The results of the ac and dc impedance tests are given for Ag, Al, C, Cu, Ni, Pb, Pt, Sn, Ti, W, Zn, and Stainless Steel, in the form of potential difference vs current and impedance vs frequency curves. Tests concerning the relative receiving impedance of Silver Silver-Chloride, Platinum Platinum-Black, carbon and zinc electrodes are reported. A comparison is made between the submerged magnetic loop and electric dipole antennas for characteristics of open circuit voltage, short circuit current, antenna gain, and noise. Based on the analytical and experimental results obtained recommendations are made to further test the impedance and noise characteristics of the Silver Silver-Chloride, Platinum Platinum-Black, and carbon electrodes. Author (GRA)

N79-25330# Naval Ocean Systems Center, San Diego, Calif.
HIGH-SPEED ELECTRO-OPTIC ANALOG-TO-DIGITAL CONVERTER Final Report for FY 1977
M. J. Taylor and H. F. Taylor Oct. 1978 24 p refs
(AD-A067022; NOSC/TR-351) Avail: NTIS HC A02/MF A01 CSCL 09/5

The periodic dependence of the output of an electro-optic intensity modulator on applied voltage can be utilized to perform A/D conversion. The feasibility of the concept has been demonstrated by such a modulator in a threshold circuit to simulate one bit channel of an A/D converter. The optical approach offers several potential improvements over present technique: faster conversion rates, fewer comparators, lower electrical power dissipation, and the opportunity to record the output on photographic film. Further work in modulator fabrication, mode-locked injection laser development, laser-to-modulator coupling techniques, and threshold optical detection techniques will be needed before the full potential of this device can be realized. Application areas include digital signal processors for wideband radar and electronic warfare systems. Author (GRA)

N79-25331# Naval Research Lab., Washington, D. C.
CORRECTION FACTORS FOR A RECIPROCITY CALIBRATION Memorandum Report

Larry A. Boles 4 Apr. 1979 14 p refs
(ZF11121003)
(AD-A067200; NRL-MR-3938) Avail: NTIS
HC A02/MF A01 CSCL 09/3

The theory for correcting the voltages measured during a reciprocity calibration is developed. The correction factor pertaining to the reciprocal transducer has not been utilized previously, but it must be considered when the capacitance of the interconnections in relation to the capacitance of the transducer exceeds the desired accuracy. Experimental verification of the theory is presented. A method for determining the equivalent capacitance of the interconnections and measurement system is also discussed. Author (GRA)

N79-25332# University of Southern California, Los Angeles.
SURFACE WAVE RESONATOR AND BULK WAVE CRYSTAL FILTERS Final Report, 1 Apr. 1976 - 30 Nov. 1978
K. M. Lakin 12 Mar. 1979 38 p refs
(Grant DAAG29-76-G-0166)
(AD-A067212; ARO-13527.1-EL) Avail: NTIS
HC A03/MF A01 CSCL 09/5

This report details a 32 month research project on surface acoustic wave, SAW, two port resonator filters, phase weighted gratings for surface wave resonators, and the equivalent circuit modeling of a thin film stacked crystal bulk wave filter. The report details a new device configuration for coupled two port SAW resonators which would allow the coupling to occur only when the grating reflectors are in resonance and would offer little coupling when the resonator is out of the resonance condition. This configuration is composed of an interdigital electrode transducer, IDT, which is placed within the grating itself but is an IDT whose periodicity is an even multiple of the wavelength. The concept of a phase weighted grating is described for use in wide band resonators. This new concept is based upon the unique properties of gratings and the concept of a movable reflection plane. A simple equivalent circuit for the thin film stacked crystal filter is derived for the first time and results in a lumped element representation for this important device. Author (GRA)

N79-25333# Brown, Boveri und Cie, A.G., Mannheim (West Germany).
HIGH CAPACITY NEUTRON GENERATOR [NEUTRONEN-GENERATOR HOHER LEISTUNG]
H. Goergemanns Bonn DOKZENTBW 1978 46 p refs In GERMAN Sponsored by Bundesmin. fuer Verteidigung
Avail: NTIS HC A03/MF A01; DOKZENTBW DM 30

Completion and testing of a neutron generator unit are described. Optimum coordination of the ion source, beam tetrode, and high voltage generator structural units was attempted. The data obtained in a laboratory experiment are tabulated. Diagrams of the neutron generator and cable installation are given. J.M.S.

N79-25334# Societe Crouzet, Valence (France). Div. Aerospatial et Systemes.
VALVE DRIVE ELECTRONICS ASSEMBLY (VDA) Final Report
M. Aulagnon, M. Duban, and M. Reinhalter Paris ESA 14 Sep. 1978 131 p
(Contract ESTEC-3316/77-NL-AK(SC))
(VD-NT-26(26/319); ESA-CR(P)-1141) Avail: NTIS
HC A07/MF A01

The design of a prototype redundant valve drive electronics assembly (VDA) is discussed. The VDA is used as part of the modular attitude and control system for the electrical actuation and monitoring of spacecraft reaction control assemblies (RCA). The main function of the VDA is to decode all the information issued from the adaptive control electronics (ACE) in order to actuate or monitor the required RCA component. The power switching amplifiers, used to connect the power bus on the RCA component to be actuated, are integrated into thick film hybrid circuits. Octocouplers provide the ground isolation required between the power bus and the VDA internal electronics. The main goal is to minimize and optimize the number of components, power consumption, weight, and volume. Author (ESA)

N79-25335# Bureau of Reclamation, Denver, Colo. Engineering and Research Center.
A PROGRAMMABLE D-C HIGH VOLTAGE RAMPED TEST SYSTEM FOR ELECTRICAL INSULATION
U. Milano Oct. 1978 23 p refs
(PB-290495/1; REC-78-7) Avail: NTIS HC A02/MF A01 CSCL 09A

A technique is presented that uses a programmable dc high voltage test set to automatically ramp the high voltage at a preselected rate while continuously recording the resultant rotating machinery stator insulation current. The principal advantage of the ramp testing technique over the conventional stepped method is the greatly improved sensitivity and accuracy of the test results. In addition, the ramp test requires only one person to run the test and provides that person with better control and sufficient lead time when a failure point is approached to avoid damaging the insulation. A full discription of the test technique, interpretation of test results, and test set operation are included. GRA

N79-25336# National Bureau of Standards, Boulder, Colo. Electromagnetic Technology Lab.
NBS RF VOLTAGE COMPARATOR
L. D. Driver, F. X. Ries, and G. Rebuldela Dec. 1978 28 p Sponsored in part by Army
(PB-292373/8; NBSIR-78-871) Avail: NTIS
HC A03/MF A01 CSCL 14B

A wideband rf voltage comparator which covers the frequency range of 100 kHz to 1 GHz from 10 mV to 20 volts is described. This device uses a pair of matched Schottky-barrier diodes in each independent channel of a 2 dual-channel configuration. The coaxial line sections are impedance compensated to assure a VSWR less than 1.03 up to 1 GHz. Applications covered are calibration of signal generators and rf voltmeters. A troubleshooting and maintenance section is included as well as illustrations and circuit diagrams to facilitate repair. GRA

N79-25337# National Bureau of Standards, Washington, D. C. National Engineering Lab.
SEMICONDUCTOR TECHNOLOGY PROGRAM, PROGRESS BRIEFS Interim Report, Apr. - Jun. 1978
W. Murray Bullis, ed. Oct. 1978 16 p Sponsored by DOE, DNA, and AFAL
(ARPA Order 2397)
(PB-292681/4; NBSIR-78-1444-3) Avail: NTIS
HC A02/MF A01 CSCL 09B

Information on the current status of NBS work in measurement technology for semiconductor materials, process control, and devices is reported. The activities include: (1) determination of resistivity dopant density relationships in silicon; (2) measurement of ion implanted dopant profiles by spreading resistance; (3) optical measurement of line widths on chrome photomasks, iron oxide photomasks, and silicon wafers; (4) sulfur impurity levels in silicon; (5) stability of thin solar cells; (6) radiation dose incurred by oxide layers during X-ray and e-beam lithographs; and (7) rectifier diode wafers. Contacts for obtaining further information are listed. GRA

N79-25082*# Colorado State Univ., Fort Collins.
PUNCTURE DISCHARGES IN SURFACE DIELECTRICS AS CONTAMINANT SOURCES IN SPACECRAFT ENVIRONMENTS
E. J. Yadlowsky, R. C. Hazelton, and R. J. Churchill *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 945-969 refs (For primary document see N79-25048 16-12)
(Grant NSG-3145)
Avail: NTIS HC A99/MF A01 CSCL 09C

N79-25098*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A TRANSMISSION LINE PHASE STABILIZER
G. Lutes *In its* The Deep Space Network 15 Jun. 1979 p 67-71 ref (For primary document see N79-25088 16-12)
Avail: NTIS HC A11/MF A01 CSCL 09C

N79-25115*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
WAVEGUIDE ARC STUDY
H. C. Yen *In its* The Deep Space Network 15 Jun. 1979 p 196-203 ref (For primary document see N79-25088 16-12)
Avail: NTIS HC A11/MF A01 CSCL 09C

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

N79-25338 Princeton Univ., N. J.
LARGE MESH REYNOLDS NUMBER COMPUTATIONS WITH APPLICATIONS TO SHOCK BOUNDARY LAYER INTERACTION PROBLEMS Ph.D. Thesis
Lie Yauw Oey 1979 295 p
Avail: Univ. Microfilms Order No. 790123

Based on the two-step Cheng-Allen algorithm, a numerical scheme for solving steady state compressiblle fluid dynamics equations was developed. Two practical problems were solved numerically in the study. The first of these involved a shock wave impinging on a laminar boundary layer and the second one involved a shock wave on a turbulent boundary layer. A wall layer layer turbulence model was developed for shock impingment on a turbulent boundary. Coupled with Clauser's eddy viscosity formulation in the outer layer, the model gave results in reasonable agreement with experiments. Dissert. Abstr.

N79-25339 Minnesota Univ., Minneapolis.
STUDIES ON ULTRAFINE AEROSOLS Ph.D. Thesis
Chong Soong Kim 1978 200 p
Avail: Univ. Microfilms Order No. 7912031

An ultrafine aerosol generator was developed and two condensation nuclei counters were characterized and calibrated for the measurement of ultrafine aerosols. The apparatus was then used to study the coagulation of ultrafine aerosols and to determine the coagulation coefficient of the ultrafine aerosols in the free molecular regime. The coagulation coefficient of the ultrafine aerosols in the free molecular regime was measured experimentally by means of a flow method. The experimental result was then compared with the theory for free molecule aerosols and was found to be about 70% higher than that predicted by the theory. However, part of the discrepancy (about 50%) can be accounted for by van der Waals forces between the particles and the polydispersity of the experimental aerosols used. Dissert. Abstr.

N79-25340 Princeton Univ., N. J.
MODELING THE FLOW OF NEWTONIAN AND VISCOELASTIC FLUIDS THROUGH POROUS MEDIA Ph.D. Thesis
Julio Alcides Deiber 1979 133 p
Avail: Univ. Microfilms Order No. 7913360

The flow of Newtonian and viscoelastic fluids through a circular tube with a radius which varies sinusoidally in the axial direction was studied. A numerical iteration technique was developed to solve the equations of motion with different fluid models. The iteration is essentially geometric. Experiments were conducted in a tube with an amplitude of radial oscillation equal to 0.3 cm and a wave length of 6.28 cm. The average tube radius was 1.0 cm. Special emphasis was placed on the distinction and recognition of the several regimes of flow related to the characteristics of the fluids involved (glycerol-water and dilute polyacrylamide-water mixtures). Results are presented through microscopic parameters. Flow patterns associated with vortices are presented through numerical calculations and recordings of tracer particle paths. Dissert. Abstr.

N79-25341 Stanford Univ., Calif.
THE DEFORMATION AND BREAK-UP OF A SINGLE SLENDER LIQUID DROP IN A LINEAR SHEAR FLOW Ph.D. Thesis
Tak Sing Lo 1979 112 p
Avail: Univ. Microfilms Order No. 7912385

A liquid drop freely suspended in another liquid undergoing motion will deform into a shape determined by a balance between the hydrodynamic and interfacial tension forces. At sufficiently large velocities, the drop may fragment into two or more smaller droplets. The deformation and break-up of a single drop in a linear shear flow was considered under conditions when the drop was slender before break-up occurred. Using the method of inner and outer expansions, the deformation behavior of an inertialess drop in an axisymmetric extensional shear was studied. When both fluid inertia and internal viscosity are negligible, a countably infinite number of steady shapes can be found for the drop at any shear rate. Dissert. Abstr.

N79-25342*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
VORTEX SIMULATION OF THREE-DIMENSIONAL, SPOT-LIKE DISTURBANCES IN A LAMINAR BOUNDARY LAYER
A. Leonard May 1979 14 p refs Presented at 2d Symp. on Turbulent Shear Flows, London, Engl., 2-4 Jul. 1979
(NASA-TM-78579; A-7789) Avail: NTIS HC A02/MF A01 CSCL 20D

The growth of a turbulent spot in a laminar boundary layer as the spot evolves from a localized disturbance in the layer, is simulated numerically using a three-dimensional vortex filament description of the vorticity field. The filaments are marked with a sequence of node points which are tracked in a Lagrangian reference frame. Velocity computation is done by Biot-Savart integration. Although some discrepancies with experiment appear to exist in the near wall region, the gross properties of the spot, including the velocities of the leading and trailing edges and the velocity perturbations away from the wall, are in good agreement with experiment. Author

N79-25343*# Virginia Polytechnic Inst. and State Univ., Blacksburg. College of Engineering.
NONLINEAR WAVE CHOKED INLETS Semiannual Progress Report, 1 Oct. 1978 - 30 Apr. 1979
1979 9 p
(Grant NsG-1573)
(NASA-CR-158691) Avail: NTIS HC A02/MF A01 CSCL 20D

The quasi-one dimensional flow program was modified in two ways. The Runge-Kutta subroutine was replaced with a subroutine which used a modified divided difference form of the Adams Pece method and the matrix inversion routine was replaced with a pseudo inverse routine. Calculations were run using both the original and modified programs. Comparison of the calculations showed that the original Runge-Kutta routine could not detect singularity near the throat and was integrating across it. The modified version was able to detect the singularity and therefore gave more valid calculations. R.E.S.

N79-25344# Canada Inst. for Scientific and Technical Information, Ottawa (Ontario).
COOLING A PLANE WALL WITH AN AIR STREAM
Wilhelm Musselt and Walter Juerges 1979 11 p refs Transl. into ENGLISH from Gesundh.-Ing. (West Ger.), v. 52, no. 45, 1922 p 641-642
(NRC/CNR-TT-1939; ISSN-0077-5606) Avail: NTIS HC A02/MF A01

The heat loss of a plane surface was determined for various air velocities. Calibrated anmeters and voltmeters were used to determine the amount of heat supplied to the heating unit. Heat was given off by the copper plate as radiation and was calculated according to the Stefan-Boltzmann law of radiation. Research using various rough surfaces were reported. When the surface of the copper plate was roughened, the coefficient of heat transmission increased by 5%, and when the plate was smoothened out, there was a slight decrease in heat transmission. M.M.M.

N79-25345# National Aeronautical Lab., Bangalore (India). Aerodynamics Div.
PRESSURE GRADIENT EFFECTS ON LAMINAR BOUNDARY LAYERS AT LARGE PRANDTL NUMBERS
R. Gopinath and A. V. Murthy 7 May 1979 37 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal in Nov. 1979
(Log-J-10972) Avail: NTIS HC A03/MF A01

An analytical study of the effect of pressure gradient on compressible, laminar boundary layers was made using the well known method of matched asymptotic expansions. Prediction of enthalpy gradient at the wall and recovery enthalpy using analytical expressions desired in this study agree with the exact numerical solutions to within 10% at a Prandtl number of 30.

for instance. The enthalpy profile shows a hill-hollow behavior for the heat transfer case and an undershoot for the wall insulated case, which is almost but not quite, a mirror image of that for beta less than 1. G.Y.

N79-25346# McGill Univ., Montreal (Quebec). Dept. of Mechanical Engineering.
EXPERIMENTAL STUDIES OF THE PRODUCTION OF CONVERGING CYLINDRICAL SHOCK WAVES
James H. T. Wu, Rafik A. Neemeh (Concordia Univ., Montreal), and P. Perry Ostrowski (Maryland Univ., College Park) 15 Jun. 1979 36 p refs Presented at 11th Intern. Symp. on Shock Waves and Tubes, Seattle, 11-14 Jul. 1977 Backup document for AIAA Synoptic scheduled for publication in AIAA Journal in Dec. 1979
(Log-J-11144) Avail: NTIS HC A03/MF A01

A simple method of producing converging cylindrical shock waves in an annular shock tube by using an axisymmetric contraction which turns a plane incident shock normal to its initial direction of propation and thereby forces it to implode is examined. In order to find an effective contraction shape, two-dimensional tests were first performed in a square shock tube containing a logarithmic spiral, a five-element or a three-element contraction profile. For an incident shock Mach number M free stream = 1.80, schlieren photography and piezoelectric pressure measurements indicate that the three-element profile produces the most stable shock in a uniform exit passage. Therefore, a three-element conical contraction was selected for use in the axisymmetric case. Shadow photography verifies that for M free steam = 2.00, this configuration produces highly symmetrical implosions although an eventual breakdown in shock front curvature is observed at very small radii. Pressure measurements in the cylindrical implosions chamber indicate that shock amplification is well predicted by the Chester-Chisnell-Whitham area-Mach number relation. J.M.S.

N79-25347*# National Aeronautics and Space Administration, Washington, D. C.
CONTRIBUTION TO THE STUDY OF TURBULENCE SPECTRA
Regis Dumas (Marseilles Coll., France) May 1979 142 p refs Transl. into ENGLISH from Publications Scientifiques et Techniques (France), Rept-404, Feb. 1964 110 p Original language document announced as A77-21847 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original document prepared by Ministere de l'Air, France
(Contract NASw-3199)
(NASA-TM-75420) Avail: NTIS HC A07/MF A01 CSCL 20D

An apparatus suitable for turbulence measurement between ranges of 1 to 5000 cps and from 6 to 16,000 cps was developed and is described. Turbulence spectra downstream of the grills were examined with reference to their general characteristics, their LF qualities, and the effects of periodic turbulence. Medium and HF are discussed. Turbulence spectra in the boundary layers are similarly examined, with reference to their fluctuations at right angles to the wall, and to lateral fluctuations. Turbulence spectra in a boundary layer with suction to the wall is discussed. Induced turbulence, and turbulence spectra at high Reynolds numbers. Calculations are presented relating to the effect of filtering on the value of the correlations in time and space. A.R.H.

N79-25348*# National Aeronautics and Space Administration, Washington, D. C.
NONLINEAR FOURIER ALGORITHM APPLIED TO SOLVING EQUATIONS OF GRAVITATIONAL GAS DYNAMICS
B. I. Kolosov May 1979 28 p refs Transl. into ENCLISH of "Nelineynyy Algoritm Eurye: Predstavleniya v Resheniy Uravneniy Gravitatsionnoy Gazodinamiki", Rept. Pr-423 Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1978 p 1-26 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75627; Pr-423) Avail: NTIS HC A03/MF A01 CSCL 20D

Two dimensional gas flow problems were reduced to an approximating system of common differential equations, which were solved by a standard procedure of the Runge-Kutta type. A theorem of the existence of stationary conical shock waves with the cone vertex in the gravitating center was proved. R.E.S.

N79-25349*# TRW Defense and Space Systems Group, Redondo Beach, Calif.
HEAT PIPE LIFE AND PROCESSING STUDY Final Report
David Antoniuk and Edward Luedke Apr. 1979 94 p
(Contract NAS3-21200)
(NASA-CR-159581; TRW-32937-6001-TU-00) Avail: NTIS HC A05/MF A01 CSCL 20D

The merit of adding water to the reflux charge in chemically and solvent cleaned aluminum/slab wick/ammonia heat pipes was evaluated. The effect of gas in the performance of three heat pipe thermal control systems was found significant in simple heat pipes, less significant in a modified simple heat pipe model with a short wickless pipe section. Use of gas data for the worst and best heat pipes of the matrix in a variable conductance heat pipe model showed a 3 C increase in the source temperature at full on condition after 20 and 246 years, respectively. Author

N79-25350*# Lockheed Missiles and Space Co., Huntsville, Ala.
THERMAL ANALYSES OF A MATERIALS PROCESSING FURNACE BEING DEVELOPED FOR USE WITH HEAT PIPES Final Report
J. V. McAnally and S. J. Robertson May 1979 43 p
(Contract NAS8-33471)
(NASA-CR-161246; LMSC-HREC-TR-D697553) Avail: NTIS HC A03/MF A01 CSCL 20D

A special materials processing furnace is being developed for the forthcoming Spacelab missions to study the solidification under closely controlled conditions of various sample materials in the absence of gravity. The samples are to be rod shaped and subjected to both heating and cooling simultaneously. The thermal model is based on a developed Thermal Analyzer computer program. The model was developed to be very general to enable the simulation of variations in the furnace design and, hence, serve as an aid in finalizing the design. The thermal model is described and a user's guide given. Some preliminary results obtained in testing the model are also given. G.Y.

N79-25351*# Universal Analytics, Inc., Playa Del Rey, Calif.
NASTRAN HYDROELASTIC MODAL STUDIES. VOLUME 1: INTRODUCTION, THEORY, AND RESULTS Final Report
31 May 1977 43 p refs 3 Vol.
(Contract NAS8-31900)
(NASA-CR-150393) Avail: NTIS HC A03/MF A01 CSCL 20D

The implementation of a general three-dimensional hydroelastic capability in the NASTRAN computer program is described. A method for analyzing the combined mode shapes of arbitrary fluid and structure finite element models was developed. The fluid was modeled with three-dimensional solid elements with options for tetrahedron, wedge, and hexahedron shapes. The elements were then connected to fluid grid points which defined the pressure in the fluid at the specified location. Matrices were formulated to provide efficient solutions for large-order problems. The structure matrices were processed separately and could be reduced using matrix condensation procedures or through a modal formulation using the normal modes of the empty structure as solution coordinates. The fluid/structure interface and the free surface were defined by the user with special NASTRAN boundary elements. A special purpose mesh generator program was provided to generate the actual NASTRAN data cards for the fluid, the structure, and the boundary elements for typical tank-type models. R.E.S.

N79-25352*# Universal Analytics, Inc., Playa Del Rey, Calif.
NASTRAN HYDROELASTIC MODAL STUDIES. VOLUME 2: PROGRAMMER DOCUMENTATION Final Report
31 May 1977 137 p 3 Vol.
(Contract NAS8-31900)
(NASA-CR-150394) Avail: NTIS HC A07/MF A01 CSCL 20D

The operational steps, data descriptions, and program code for the new NASTRAN hydroelastic analysis system are described. The overall flow of the system is described, followed by the

descriptions of the individual modules and their subroutines.
R.E.S.

N79-25353*# Universal Analytics, Inc., Playa Del Rey, Calif.
NASTRAN HYDROELASTIC MODAL STUDIES. VOLUME 3: NASTRAN 3-D HYDROELASTIC ANALYSIS AND MESHGEN USER'S MANUALS Final Report
31 May 1977 139 p 3 Vol.
(Contract NAS8-31900)
(NASA-CR-158720; UAI8-31900-FR-1-Vol-3) Avail: NTIS HC A07/MF A01 CSCL 20D

The method used to formulate the fluid/structure equations is described in the updates to the NASTRAN Theoretical Manual. The basis for defining the fluid are three dimensional finite elements connected to fluid grid points defining the Eulerian pressure at a point fixed in space. The use of a pressure single degree of freedom at each point rather than three displacements allows a finer mesh of elements with a reasonable matrix order. In the formulation of the fluid/structure system the interior fluid degrees of freedom are transformed and removed from the solution matrices. The eigenvalues of the combination are extracted from small, fully dense, symmetric mass and stiffness matrices, efficiently processed with the Givens method. The solution matrices are defined by the free surface displacements and the reduced structure coordinates. M.M.M.

N79-25354# Connecticut Univ., Storrs. Dept. of Mechanical Engineering.
VARIABLE ENERGY BLAST WAVES AND TWO PHASE DETONATIONS Final Report, 1 Jan. 1973 - 30 Sep. 1978
E. K. Dabora Feb. 1979 52 p refs
(Grants DA-ARO(D)-31-124-73-G100; DAAG29-76-G-0142; DAAG29-77-G-0112)
(AD-A067334; UCONN-0507-121-F; ARO-11052.5-E; ARO-13483.3-E) Avail: NTIS HC A04/MF A01 CSCL 19/4

The results of the research work performed to determine the role of blastwaves and mass addition within the reaction zone of spray detonations are summarized. Since most of the findings have been published in the literature, abstracts of the relevent publications have been included. One of the publications describes a model for spray detonations in which the relevant parameters are found to be the ignition delay and the energy temporal variation within the reaction zone. The model can predict the minimum energy for direct initiation when these parameters are known. Recent experiments on laser ignition of fuel drops to simulate the mass addition aspect within the reaction zone are reported in detail. These experiments indicate the mass addition effects are small when compared to the blast wave effects. However, they reveal that, under some conditions, explosive combustion can take place. The experiments appear to be the first of their kind and open up new avenues for research on liquid propellants, fuel-air explosions and detonation transfer.
Author (GRA)

N79-25355# Toronto Univ., Downsview (Ontario). Inst. for Aerospace Studies.
SURVEY OF FLOWS WITH NUCLEATION AND CONDENSATION Interim Report
S. Kotake (Tokyo Univ.) and I. I. Glass Oct. 1978 96 p refs
(Grant AF-AFOSR-3303-77; AF Proj. 2307)
(AD-A066751; UTIAS-Review-42) Avail: NTIS HC A05/MF A01 CSCL 20/4

A survey is presented of recent studies of homogeneous and heterogeneous nucleation and condensation processes and associated flows. The phenomenological (classical) theory of the quasi-steady droplet-formation model with appropriate correction factors can be made to fit homogeneous nucleation and condensation processes in cloud-chamber, supersonic-nozzle and shock-tube flows. Statistical thermodynamics and numerical methods have made it possible to understand small-cluster formation. Free-molecular techniques contributed significantly to the study of the kinetic processes of clusterization (especially dimerization) and to dynamic properties of small clusters. Heterogeneous nucleation is considered as an extension of the macroscopic theory of homogeneous nucleation. Considerable contributions are expected to the kinetics of heterogeneous condensation from flows in cloud chambers, supersonic nozzles and shock tubes for macroscopic features and from free-molecular-beam techniques for microscopic properties. Author (GRA)

N79-25356# Naval Postgraduate School, Monterey, Calif.
INVESTIGATION OF PIPE FLOW INSTABILITY AND RESULTS FOR WAVE NUMBER ZERO M.S. Thesis
Michael James Arnold Dec. 1978 123 p refs
(AD-A066374) Avail: NTIS HC A06/MF A01 CSCL 20/4

Past research by Harrison and Johnston on the stability of pipe flow yielded only tenuous results owing to errors in setup of the problem and in formulation of the complex axis boundary conditions. Recent advances in the formulation of these boundary conditions and application of generalized stability criteria allowed an accurate numerical solution to be made for angular wave number zero. The results show that flow for this case is characterized by certain instabilities that have not been previously identified in linearized studies of this type. A nonuniform computational mesh was developed which provided dramatic reductions in computational time on a limited basis. Two data reduction programs were also developed to process and display data generated by the main program. Author (GRA)

N79-25357# Naval Postgraduate School, Monterey, Calif.
THE APPLICATION OF A LASER DOPPLER VELOCIMETRY SYSTEM TO FLOW VELOCITY MEASUREMENTS IN A TRANSONIC COMPRESSOR M.S. Thesis
Jeffrey Alan Harrison Dec. 1978 70 p refs
(AD-A066371) Avail: NTIS HC A04/MF A01 CSCL 20/4

A laser Doppler velocimeter (LDV) system was developed and utilized to measure the flow velocities in the axial and tangential directions behind the rotors of a single stage transonic compressor. The backscatter mode was used to acquire the scattered light signals from particles that were seeded into the airflow upstream of the compressor. The light signals were generated as the particles traversed a fringe pattern produced by the intersection of two laser beams. The LDV system proved that it was possible to make velocity measurements in the transonic compressor. The results revealed a variation of the flow velocity in both the axial and tangential directions due to the formation of a wake caused by the passage of rotor blades. The velocity measurements were comparable to those acquired through pressure probe measurements. Author (GRA)

N79-25358# Naval Research Lab., Washington, D. C. Ocean Sciences Div.
THE GRAVITY-CAPILLARY WAVE INTERACTION APPLIED TO WIND-GENERATED, SHORT-GRAVITY WAVES Interim Report
William J. Plant 8 Feb. 1979 16 p refs
(RR0310341)
(AD-A066900; AD-E000279; NRL-8289) Avail: NTIS HC A02/MF A01 CSCL 20/4

The gravity-capillary wave interaction has been simplified for the special case where one component of the interacting triad is a short-gravity wave. Wind-speed effects have been included in an ad hoc manner by forcing the dispersion relation to conform to that found in microwave scattering experiments. The results show that the interaction may be envisioned as occuring between the short-gravity wave and a capillary wave whose group speed equals the phase speed of the gravity wave. The interaction dies out as the wave number of the gravity wave decreases, having a k to the 5/2 power dependence in the no-wind case. Comparisons with more accurate numerical evaluations of the interaction are given. Author (GRA)

N79-25359# Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.
NUMERICAL SOLUTIONS FOR A GENERAL SET OF PROBLEMS BY AN ALTERNATING STRONGLY IMPLICIT PROCEDURE
D. W. Pepper and R. E. Cooper 1978 9 p refs Presented at the Intern. Conf. on Numerical Methods in Laminar and Turbulent Flow, Swansea, United Kingdom, 18-21 Jul. 1978
(Contracts EY-76-C-09-0001; AT(07-2)-1)
(DP-MS-78-53; Conf-780712-6) Avail: NTIS HC A02/MF A01

A generalized numerical method is developed for analyzing the following problems: driven laminar flow past a square cavity,

laminar flow past a cylinder located in an infinite fluid, transient analysis of the preceding problem, and heat transfer in driven laminar flow past a cavity. DOE

N79-25360# National Technical Information Service, Springfield, Va.
HEAT PIPES, VOLUME 3. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, Apr. 1977 - Mar. 1979
William E. Reed Apr. 1979 214 p Supersedes NTIS/PS-78/0304; NTIS/PS-76/0251
(NTIS/PS-79/0299/2; NTIS/PS-78/0304; NTIS/PS-76/0251) Avail: NTIS HC $28.00/MF $28.00 CSCL 13A

Research reports covering the thermodynamics, design, fabrication, and applications of heat pipes are cited from worldwide literature. Applications are described in the areas of electronics cooling, spacecraft thermal control, heat exchangers, heating and refrigeration, and waste heat utilization. This updated bibliography contains 208 abstracts, 77 of which are new entries to the previous edition. GRA

N79-25361# National Technical Information Service, Springfield, Va.
HEAT PIPES VOLUME 3. CITATIONS FROM THE NTIS DATA BASE Progress Report, Mar. 1976 - Mar. 1979
William E. Reed Apr. 1979 254 p Supersedes NTIS/PS-78/0302; NTIS/PS-77/0275; NTIS/PS-76/0249; NTIS/PS-75/317
(NTIS/PS-79/0298/4; NTIS/PS-78/0302; NTIS/PS-77/0275; NTIS/PS-76/0249; NTIS/PS-75/317) Avail: NTIS HC $28.00/MF $28.00 CSCL 13A

Theory, design, fabrication, testing, and operation of heat pipes are presented in these Federally-sponsored research reports. Applications are described in the areas of heating and air conditioning power generation, electronics cooling, spacecraft, nuclear reactors, cooling engines, and thermodynamics. This updated bibliography contains 247 abstracts, 77 of which are new entries to the previous edition. GRA

N79-25061*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CONTAMINATION AND HEAT TRANSFER PROBLEMS RESULTING FROM HIGH EXPANSION OF THE SUBSONIC BOUNDARY LAYER FLOW IN THE VOYAGER TE-M-364-4 SOLID ROCKET MOTOR
Charles J. Leising and Morris L. Greenfield *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 385-400 ref (For primary document see N79-25048 16-12) (Contract NAS7-100)
Avail: NTIS HC A99/MF A01 CSCL 20D

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N79-25362 Arizona Univ., Tucson.
AN ION TIME-OF-FLIGHT SPECTROMETER WITH MASS ANALYSIS Ph.D. Thesis
Michael Daniel Burrows 1979 150 p
Avail: Univ. Microfilms Order No. 7912540

The design, construction, and operation of an ion time of flight spectrometer with mass analysis was discussed, and resultant spectra of H(+), H2(+), and H3(+) ions acquired using electron impact bombardment of methanol, ethanol, methane, and ethane, were examined in detail. Corresponding light fragments from CD3OD, CH3OD, and CD3OH were also observed. The results for these deuterated methanols were useful in elucidating the locations of hydrogenic atoms contributing to H2(+) and H3(+) formation. Spectra for H(+) and H2(+) ions from methane and ethane were in substantial agreement with other experiments for ion energies exceeding 1 eV. At 100 volt electron impacts the ratios of the total H3(+) to H(+) intensities for fragment kinetic energies exceeding 2 eV were 0.035 and 0.038 for methanol and ethanol, respectively. Dissert. Abstr.

N79-25363 Illinois Inst. of Tech., Chicago.
DESIGN AND ANALYSIS OF A TENSILE CREEP VISCOMETER Ph.D. Thesis
M. Shawqui Lahalih 1978 104 p
Avail: Univ. Microfilms Order No. 7913101

A tensile creep viscometer was designed and built to meet the basic requirements of extensional rheology. Large deformations and deformation rates can be realized in a uniform strain field which is free of end effects. A wide range of viscosities and moduli can be obtained in a controlled test environment. The loading system is designed with minimum of friction and the clamps are slippage-free up to 180 C under a maximum load of five kilograms. The tensile creep viscometer is versatile so that multiple testing can be conducted. It was used quite successfully to characterize molecular orientation. A method was developed to analyze the creep experiments for finite deformations where finite linear viscoelasticity is applicable. Viscoelastic properties of linear amorphous polystyrene were obtained in the temperature range 110.7 - 179.9 C. Dissert. Abstr.

N79-25364*# Wentz (Frank J.) and Associates, San Francisco, Calif.
DESIGN STUDY FOR FUTURE SATELLITE MICROWAVE SCATTEROMETERS, PART 3 Final Report
Frank J. Wentz 26 Mar. 1979 27 p refs
(Contract NAS1-15288)
(NASA-CR-159079; FWA79-003-Pt-3) Avail: NTIS HC A03/MF A01 CSCL 14B

A computerized simulation analysis for a number of scatterometer antenna configuration and polarization modes including the Seasat scatterometer (SASS) is presented. The results of the simulations were expressed in terms of performance statistics. These statistics relate to the wind direction alias removal capability and to the rms sensing errors for friction velocity and wind direction X. The statistics are analyzed, and optimum scatterometer configurations are recommended. The accuracy of the SASS in measuring U* and X, and its capability to resolve wind direction aliases are assessed. M.M.M.

N79-25365# Rockwell International Corp., Anaheim, Calif. Autonetics Strategic Systems Div.
RING LASER GYRO MIRROR SUBSTRATE INVESTIGATION Final Report, 28 Apr. 1977 - 28 Jan. 1978
R. D. Henry, D. Medellin, and J. H. W. Liaw May 1978 95 p refs
(Contract F33615-77-C-1091; AF Proj. 6095)
(AD-A066610; C77-492/201; AFAL-TR-78-52) Avail: NTIS HC A05/MF A01 CSCL 17/7

This report discusses methods for the fabrication and characterization of multilayer dielectric mirrors using single crystal garnet substrates. Polishing of garnet substrates to the required flatness for laser mirrors is described. The results of adhesion testing of SiO2/TiO2 multilayer dielectric high reflectance coatings on garnets are discussed. Lastly, the results of characterization of the mirrors by scattering measurements and lock-band measurements are described as well as correlation of these two evaluation tools with regard to prediction of mirror performance in a ring laser. Emphasis is on the experimental aspects of the work. GRA

N79-25366# Bendix Corp., Kansas City, Mo.
HIGH-PRECISION THICKNESS MEASUREMENTS USING BETA BACKSCATTER
R. V. Heckman Nov. 1978 31 p refs Revised
(Contract EY-76-C-04-0613)
(BDX-613-2009-Rev) Avail: NTIS HC A03/MF A01

A two-axis, automated fixture for use with a high-intensity Pm-147 source and a photomultiplier-scintillation beta-backscatter probe for making thickness measurements was designed and built. A custom interface was built to connect the system to a minicomputer, and software was written to position the tables, control the probe, and make the measurements. Measurements

can be made in less time with much greater precision than by the method previously used. DOE

N79-25367# National Physical Lab., Teddington (England). Div. of Mechanical and Optical Meteorology.
THE ACCURATE MEASUREMENT OF THE VOLUME RATIOS OF VACUUM VESSELS
K. W. Elliott and P. B. Clapham Jan. 1978 22 p refs
(NPL-MOM-28) Avail: NTIS HC A02/MF A01

A successive expansion method for determining the volume ratios of vacuum vessels is described. To illustrate the method, results obtained in setting an NPL series expansion vacuum standard are presented and discussed. It is shown that ratios of up to a few 100:1 may be determined with measurement uncertainty of about + or - 0.1%. Author (ESA)

N79-25368# Bureau of Radiological Health, Rockville, Md. Div. of Electronic Products.
EVALUATION OF OHMIC INSTRUMENT COMPANY UPM-30 ULTRASOUND POWER METER Final Report
Jesse L. Abzug Nov. 1978 20 p refs
(PB-292405/8; DHEW/PUB/FDA-78/8075; FDA/BRH-79/64)
Avail: NTIS HC A02/MF A01 CSCL 14B

The Bureau of Radiological Health and the National Bureau of Standards evaluated a commercially available ultrasound power meter designed to measure the outputs from ultrasonic physical therapy units. The parameters investigated include accuracy, repeatability, temperature and position dependence, and ultrasound transmission medium dependence. GRA

N79-25067*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MASS SPECTROMETER FOR IECM. PART 1: DESCRIPTION. PART 2: MEASUREMENT CONCEPTS
R. C. Ruff, D. R. Taeusch (Mich. Univ., Ann Arbor), W. A. Oran, and T. Rathz *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 567-604 refs (For primary document see N79-25048 16-12)
Avail: NTIS HC A99/MF A01 CSCL 14B

N79-25068*# Faraday Labs., Inc., La Jolla, Calif.
QUARTZ CRYSTAL MICROBALANCE SYSTEMS FOR SHUTTLE CONTAMINATION MEASUREMENTS
D. McKeown and C. R. Claysmith *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 605-628 refs (For primary document see N79-25048 16-12) (Contract NAS8-32110)
Avail: NTIS HC A99/MF A01 CSCL 14B

N79-25069*# Berkeley Controls, Inc., Irvine, Calif.
CONSIDERATIONS IN THE USE OF QCMs FOR ACCURATE CONTAMINATION MEASUREMENT
D. A. Wallace *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 14-33 refs (For primary document see N79-25048 16-12)
Avail: NTIS HC A99/MF A01 CSCL 14B

N79-25070*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EVALUATING A CONTAMINATION HAZARD WITH A RESIDUAL GAS ANALYZER
Raymond Kruger *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 644-656 refs (For primary document see N79-25048 16-12)
Avail: NTIS HC A99/MF A01 CSCL 14B

36 LASERS AND MASERS

Includes parametric amplifiers.

N79-25369 Catholic Univ. of America, Washington, D. C.
STARK EFFECTS ON AN OPTICALLY PUMPED SUBMILLIMETER LASER Ph.D. Thesis
Mary Stones Tobin 1979 157 p
Avail: Univ. Microfilms Order No. 7911311

The Stark effects on the output power were characterized for a number of laser parameters and field orientations relative to the pump and submillimeter laser polarization. The result of 100% and larger power enhancement was observed for fields near 80 volt/cm for CH3F for the orientation of Stark field perpendicular to both the pump and submillimeter laser polarization. At higher Stark fields the power decreased. A simplified model which includes coupling of the molecular gain polarization characteristics with the waveguide polarization constraints was developed. Calculations based on this model show reasonable agreement with the experimental results for CH3F. Nonlinear level crossing effects were also considered qualitatively.
Dissert. Abstr.

N79-25370 State Univ. of New York at Buffalo.
STUDIES ON LASER INTRACAVITY SPECTROSCOPY Ph.D. Thesis
Harinarayana Sarma Lakkaraju 1979 114 p
Avail: Univ. Microfilms Order No. 7913898

Intracavity absorption, at low densities of sodium the probe absorber, was found to vary linearly with the absorber density. The change in the laser intensity due to the presence of the absorber increased with the ratio of the pump power to the threshold pump power while the relative change decreased slightly. The line width of the intracavity absorption signal at high densities of the absorber was observed to be larger than the instrumental width and the line shapes were complex. The line width and the line shape were also found to depend on the laser scan rate across the absorption line. During the course of the intracavity absorption experiments, the laser brightened at the sodium absorption wavelengths instead of showing a loss of intensity due to the absorption if the pump power was above a certain value with respect to the threshold pump power.
Dissert. Abstr.

N79-25371 Rensselaer Polytechnic Inst., Troy, N. Y.
SEMICLASSICAL, MULTILEVEL PULSED LASER AMPLIFIER: COMPUTER SIMULATION FOR MOLECULAR NITROGEN Ph.D. Thesis
Daniel Mitchell Litynski 1978 352 p
Avail: Univ. Microfilms Order No. 7913081

Pulse propagation in a multilevel laser amplifier is investigated using a semiclassical theory. The evolution of the active medium is described by coupled equations of motion for the density matrix representing quantum mechanical probability amplitudes. The one dimensional electromagnetic field is treated classically by Maxwell's equations. The dipole approximation is assumed to hold for the interaction of atoms with the field. The wave equation for the electromagnetic field is driven by the macroscopic polarization which is a summation over dipole moments. Homogeneous broadening is assumed. Phenomenological decay constants are used. A two level pulse propagation approach is extended to a general multilevel system under certain assumptions. Several hypothetical cases were considered for both two and three level systems. Dissert. Abstr.

N79-25372 California Univ., Los Angeles.
PLASMA LIPOPROTEIN DISTRIBUTIONS: ANALYSIS BY LASER LIGHT SCATTERING OF CENTRIFUGED SOLUTIONS Ph.D. Thesis
Steven Taro Kunitake 1979 181 p
Avail: Univ. Microfilms Order No. 7913740

The distribution of particles within a lipoprotein class was studied by a technique, laser light scattering from centrifuged solutions (LASCENT). Several different very low density lipoprotein (VLDL) samples were investigated. In addition, a new lipoprotein class was discovered in normal bovine plasma and its physical properties were examined. Plasma lipoprotein density classes were polydisperse collections of particles in that several metabolically different lipoprotein species may be grouped in a single class.
Dissert. Abstr.

N79-25373# National Physical Research Lab., Pretoria (South Africa).
THE IODINE STABILIZED LASER RESEARCH AT THE NATIONAL PHYSICAL RESEARCH LABORATORY
B. P. J. Vanoorschot and C. J. Vanderhoeven 1978 38 p refs
(CSIR-RR-341) Avail: NTIS HC A03/MF A01

The design, construction, and testing of iodine stabilized lasers is described. Reproducibilities of about two parts in 10 to the 11th power and stabilities of four parts in 10 to the 13th power (over a 400 second sampling period) were achieved. R.E.S.

N79-25374*# Alabama A & M Univ., Normal.
ATMOSPHERIC EFFECTS ON COHERENT LASER SYSTEMS Final Report, Jun. 1978 - Jun. 1979
S. S. R. Murty 1979 20 p refs
(Grant NsG-8037)
(NASA-CR-158692) Avail: NTIS HC A02/MF A01 CSCL 20E

Effects of the truncation of the gaussian beam by the telescope on the signal to noise ratio were studied. Finite and infinite beams were also considered, along with the refractive index structure constant. J.A.M.

N79-25375# Aerospace Corp., El Segundo, Calif. Aerophysics Lab.
MEASUREMENT OF PHASE FLUCTUATIONS IN A HF CHEMICAL LASER BEAM
C. P. Wang and R. L. Varwig May 1979 29 p refs
(ATR-79(8408)-1) Avail: NTIS HC A03/MF A01

A phase detector which uses an acousto-optic modulation and optical heterodyne technique was developed. The minimum detectable phase difference is 4 deg, with a temporal response of 10 micron sec and a spatial resolution of 0.14 mm. The phase detector was used to measure fluctuations in the wavefront of a CW HF chemical laser beam caused by mechanical vibration, medium turbulence, and gain variation. Potential applications are laser beam quality measurement, beam steering measurement, and sensing for an active resonator. Author

N79-25376# Michigan Univ., Ann Arbor. College of Engineering.
THERMAL SELF-FOCUSING OF A LASER BEAM IN DENSE, LOW TEMPERATURE PLASMA
R. S. B. Ong and Andrew Schmitt Feb. 1979 23 p refs
(Grant AF-AFOSR-2904-76)
(AD-A066795; U-Mich-013746-11-T; AFOSR-79-0369TR) Avail: NTIS HC A02/MF A01 CSCL 20/5

The thermal self-focusing of a Gaussian electromagnetic beam incident upon a dense, low temperature plasma is discussed. The behavior of the beam as it propagates through the plasma is analyzed. A measure of the penetration depth of the beam in an inhomogeneous plasma as a function of its power is given. Author (GRA)

N79-25377# ARO, Inc., Arnold Air Force Station, Tenn.
AN EVALUATION OF THE USE OF TUNABLE INFRARED SOURCES FOR AEDC SENSOR TESTING Final Report, Jul. 1976 - Sep. 1977
L. L. Price and J. W. L. Lewis AEDC Mar. 1979 38 p refs
(AD-A067316; AEDC-TR-78-67) Avail: NTIS HC A03/MF A01 CSCL 17/5

In an effort to increase the capability of infrared sensor testing at AEDC due to the requirements of advanced technology sensors, various novel, state-of-the-art infrared sources were considered as immediate supplements to or eventual replacements for existing sources. Recent and future source requirements such as sufficiently narrow linewidth, wavelength calibration accuracy, and large dynamic range of intensity cannot be met by blackbody-type sources and their attendant optics. A multiplicity of modern infrared radiation generation techniques exists, and two of these, the tunable diode lasers and difference-frequency generation, were identified as potential short-term and long-term solutions to at least some of the new requirements. In addition, a diode laser was rented for a one-month period for an experimental evaluation of particular characteristics of importance in its proposed sensor testing application. Author (GRA)

N79-25378# Naval Research Lab., Washington, D. C.
A HIGH-POWER, FREE-ELECTRON LASER BASED ON STIMULATED RAMAN BACKSCATTERING
D. B. McDermott (Columbia Univ., N. Y.), T. C. Marshall (Columbia Univ., N. Y.), R. K. Parker (Columbia Univ., N. Y.), S. P. Schlesinger, and V. L. Granatstein 16 Feb. 1979 15 p refs
(RR0110941)
(AD-A067298; AD-E000283) Avail: NTIS HC A02/MF A01 CSCL 20/5

A free electron laser using an intense relativistic electron beam in a rippled magnetic field has been operated in the stimulated Raman scattering regime to yield megawatt-level radiation at submillimeter wavelengths; line-narrowing to Delta lambda/lambda approximately 2% is reported. Author (GRA)

N79-25379# Rockwell International Corp., Anaheim, Calif. Electronics Research Center.
WAVEGUIDE OPTICS FOR COHERENT OPTICAL PROCESSING Final Technical Report, 15 Jan. 1977 - 15 Jan. 1978
D. B. Anderson, S. K. Yao, V. G. Kreismanis, R. R. August, J. T. Boyd, C. H. Oania, and B. R. Youmans Jun. 1978 238 p refs
(Contract F33615-77-C-1017)
(AD-A062933; C77-210.13/501; AFAL-TR-78-83) Avail: NTIS HC A11/MF A01 CSCL 20/6

The results of an effort to further improve thin-film waveguide Luneburg lenses for implementation of the optical Fourier transform as may be employed for real time wideband RF, spectrum analysis was delineated. Overlay Ta205 thin film, waveguide, Luneburg lenses on Corning 7059 waveguide on thermally-grown Si02 on a silicon substrate were demonstrated achieving the diffraction-limited results. The smallest beamwidth observed was 1.65 microns for an F/4 Luneburg lens design with side lobes below 17 dB decaying to approximately 30 dB. A numerical procedure was developed and applied to compute the performance of these lenses using waveguide thickness profile ray traces to determine the ray intercepts in the image plane to provide the wavefront phase error and to determine the resulting intensity diffraction pattern. GRA

N79-25380# Maryland Univ., College Park. Dept. of Aerospace Engineering.
NAVIER-STOKES SOLUTIONS FOR CHEMICAL LASER FLOWS: STEADY AND UNSTEADY FLOWS
Ajay P. Kothari, Everett Jones, and John D. Anderson, Jr. Jan. 1979 17 p refs Presented at the 17th Aerospace Sci. Meeting, New Orleans, 15-17 Jan. 1979
(Contract N00014-77-C-0257)
(AD-A066791; Paper-79-0009) Avail: NTIS HC A02/MF A01 CSCL 20/5

Time-dependent finite-difference solutions of the two-dimensional Navier-Stokes equations, fully coupled with the appropriate finite-rate chemical kinetic equations, are obtained for HF chemical laser flows. These solutions demonstrate the practicality of Navier-Stokes solutions for chemical laser flows. Results are given for steady flows where large pressure gradients are calculated as a natural part of the Navier-Stokes solutions. In addition, the effect of unsteady fluctuations intentionally introduced at the cavity inlet are studied. Such unsteady mixing increases the laser gain by more than a factor of two. Author (GRA)

N79-25381# California Univ., San Diego, La Jolla. Inst. for Pure and Applied Physical Sciences.
X-RAY PREIONIZATION FOR ELECTRIC DISCHARGE LASERS Final Technical Report, 1 Jul. 1977 - 30 Jun. 1978
Shao-Chi Lin and Jeffrey I. Levatter 30 Jun. 1978 14 p refs
(Contracts N00014-77-C-0692; N00014-76-C-0116)
(AD-A066523) Avail: NTIS HC A02/MF A01 CSCL 20/5

Using x-rays of 60-200 keV photon energy (lambda ranges 0.06 to 0.2 A) as an ionizing radiation source in a transmission-line-driven, low-inductance discharge chamber, we have succeeded in generating spatially-homogeneous pulsed avalanche discharges of several liter volume at greater than 1 atm pressure for up to 100 nsec duration. In concurrent laser generation experiments with relatively lossy windows, we have observed high optical quality pulsed UV laser output of up to 2 J/liter from such discharges in rare gas/halogen mixtures, and ir laser output of up to 12.5 J/liter from a He/N2/CO2 mixture. GRA

N79-25382# Harry Diamond Labs., Adelphi, Md.
ELECTRO-OPTIC MODULATION OF CO2 LASER LIGHT
Dennis P. Wilkins Dec. 1978 37 p refs
(AD-A066611; HDL-TR-1872) Avail: NTIS HC A03/MF A01

CSCL 09/3

An experiment was performed to obtain single-sideband modulation of circularly polarized CO2 laser radiation. The sideband was generated through the application of an effectively rotating electric field to an electro-optic crystal of cadmium-telluride through which light was passed. The theoretical basis for producing the frequency shift is presented as well as a detailed description of the experimental procedures and results. Frequency shifts of 200 to 500 MHz were obtained with an efficiency of 0.01 percent, and carrier-to-sideband suppression ratios up to 45 dB were achieved. Methods for improving these values are suggested which would allow the frequency-shifted signal to be used as the local oscillator in a heterodyne-detection system with state-of-the-art photovoltaic mercury-cadmium-telluride detectors. Author (GRA)

N79-25383# International Laser Systems, Inc., Orlando, Fla.
RPV ACTIVE BORESIGHT INVESTIGATION Final Report, 22 Feb. - 1 Dec. 1978
Jean A. Potvin, D. Allan Roberts, and Wright Scidmore 15 Dec. 1978 102 p refs
(Contract DAAK70-78-C-0014)
(AD-A066379) Avail: NTIS HC A06/MF A01 CSCL 17/8

Analytic and experimental studies were performed to generate design approaches for a miniature Remotely Piloted Vehicle (RPV) electro-optical sensor system. The RPV has a stringent weight limitation; therefore the emphasis was on approaches that would increase precision laser designation performance while reducing size and weight. Laser designator to silicon vidicon boresight is a critical parameter for precision laser designation and passive design approaches usually employed increase the weight of the sensor. Automatic active boresight techniques that tolerate a lighter and less rigid mechanical structure can significantly decrease weight and improve performance. Common laser/TV optics designs were investigated because they yield the smallest total clear aperture and permit the introduction of automatic active boresight techniques. GRA

N79-25384# Calspan Advanced Technology Center, Buffalo, N. Y.
MEASUREMENT OF KINETIC RATES FOR CARBON MONOXIDE LASER SYSTEMS Final Report, May - Dec. 1977
J. W. Rich, R. C. Bergman, and M. J. Williams Nov. 1978 26 p refs
(Contract F49620-77-C-0020)
(AD-A066721; CALSPAN-WG-6021-A-21) Avail: NTIS HC A03/MF A01 CSCL 05/9

The vibration-translation (V-T) deactivation rates for high vibrational quantum levels of carbon monoxide have been measured for collisions of carbon monoxide with argon at room temperature. The rates are quantum-state-resolved and have now been measured for quantum levels from V = 10 up to V = 42. A laser optical pumping technique is used; the measurements are in an environment free of electric discharge effects. In a related phase of the program, evidence of molecular vibration-to-electronic (V-E) energy transfer has been adduced. Preliminary analysis of this process is given, and potential V-E transfer laser action, based on highly vibrationally excited CO, is assessed. Author (GRA)

N79-25385# Michigan Univ., Ann Arbor. Dept. of Aerospace Engineering.
MEASUREMENT OF SIZE DISTRIBUTION OF SUBMICRON PARTICLES USING NEW LASER DIAGNOSTICS Final Report
James F. Driscoll Mar. 1979 31 p refs
(Grant AF-AFOSR-3556-78)
(AD-A066716; AFOSR-79-0353TR) Avail: NTIS HC A03/MF A01 CSCL 21/2

The one year research program described here was a direct extension of work completed during the 1977 AFOSR/ASEE Summer Faculty Research program at AFRPL. During that program the author and Dr. David Mann, AFRPL, performed the first in situ size measurements of submicron alumina (Al2O3) particles that have been published to date. The new laser diagnostic technique used, Diffusion Broadening Spectroscopy, represents a new advance in the state-of-the-art of submicron particle sizing. The goal of the research described herein was to develop a data reduction procedure to extend the applicability of the technique, so that size distribution half width can be measured, in addition to particle mean diameter. The computer routine was developed to determine particle mean diameter and size distribution half width, given light scattering data obtained at two scattering angles. Sensitivity of the results was investigated and feasibility of future use of the technique in rocket motors and plumes was deduced. Author (GRA)

N79-25386# Ballistic Research Labs., Aberdeen Proving Ground, Md.
BRL BEAM DIAGNOSTIC SUPPORT OF UNFTP Final Report
Morgan T. Reedy Nov. 1978 27 p
(AD-A066527; AD-E430179; ARBRL-MR-02882) Avail: NTIS HC A03/MF A01 CSCL 09/2

The BRL Infrared Data Acquisition and Processing System (IRDAPS) is a computer based, field portable, acquisition and processing facility designed expressly to support remote HEL field test programs. This report presents a summary of BRL Beam Diagnostic Support of the Unified Navy Field Test Program (UNFTP) recently concluded at Capistrano Beach, CA. It discusses the role of IRDAPS in providing quick look analytical beam diagnostic data as inputs to on-site management decisions regarding beam quality and its impact on overall experimental goals. Beam parameters, as calculated by IRDAPS, are discussed and interpreted. Included are typical data tabulations and plots to support these discussions. This report also points out that, although IRDAPS bore the full burden of all on-site beam data processing, at no time was a program delay encountered due to lack of response or IRDAPS equipment failure. GRA

N79-25387# Los Alamos Scientific Lab., N. Mex.
COMPREHENSIVE STUDY OF EXCIMER LASER SYSTEMS
Robert Ray Butcher Jun. 1978 107 p refs
(Contract W-7405-eng-36)
(LA-7329-T) Avail: NTIS HC A06/MF A01

A parametric study on electrical discharge excimer laser systems is described. A flashboard pre-ionized excimer laser utilizing a cable pulse forming network (PFN) for the main discharge was designed and tested. Extensive voltage and current data were taken with various gas mixtures at various pressures. The effects of varying the length and impedance of the cable PFN were studied. A comparison of the computer simulated voltage and current pulse to the measured data indicates the data is internally consistent. Two experiments are described using the lasers studied. A series of Raman scattering experiments was conducted to obtain levels of energy and wavelengths which were beyond the reach of other experimenters. The high power and beam quality achieved with these lasers was adequate for the purposes of the experiments. Conclusions are presented relating to the scaling factors for excimer laser systems. DOE

N79-25388# Technische Hochschule, Vienna (Austria). Inst. fuer Hochfrequenztechnik.
ASSESSMENT OF MODULATORS FOR HIGH DATA RATE LASER LINKS Final Report
Walter R. Leeb, Arpad L. Scholtz, Ernst Bonek, and Hermann Krammer Paris ESA 31 Aug. 1978 367 p refs
(Contract ESTEC-3189/77-NI-AK(SC))
(ESA-CR(P)-1142) Avail: NTIS HC A16/MF A01

Modulators for data rates of 1 Gbit/sec or more for CO2 lasers and Nd:YAG lasers are compared. Physical and engineering background necessary to assess modulator concepts are provided. A selection of promising concepts, both for short term and long term development, is made. The characteristics of the short term candidates are evaluated in detail. Emphasis is laid on the 10.6 micrometer wavelength modulator. For this wavelength the design of an external light pipe traveling wave modulator is presented, where several CdTe crystals are placed in series to form an electro-optic structure with an aspect ratio of 330. Electrically, the modulator constitutes a symmetric strip line bed by a push-pull driver. For the Nd:YAG laser a lumped bulk polarization modulator is evaluated with LiNbO3 as the electro-optic material for a 1.06 micrometer wavelength and LiTaO3 for a micrometer wavelength. Author (ESA)

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N79-25389 Engineering Sciences Data Unit, London (England).
CALCULATION METHODS FOR STEADILY LOADED PRESSURE FED HYDRODYNAMIC JOURNAL BEARINGS
Feb. 1978 70 p Supersedes ESDU-66023, Sep. 1966
(ESDU-66023) For information on availability of series, sub-series, and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161 HC E99

Data for calculating bearing design dimensions and configurations for given load, shaft diameter, and speed are given. Performance characteristics evaluated include load carrying capacity, power loss, minimum film thickness, lubricant flow rate, and temperatures. Supplementary quidance on various design aspects is given. ESDU

N79-25390 Engineering Sciences Data Unit, London (England).
EQUILIBRIUM ASSEMBLIES. PART 3: ESTIMATION OF THERMAL RESISTANCE OF AN ASSEMBLY
1978 33 p Also published as ISSN-0141-2590 For part 4 see ESDU-78029
(ESDU-78028; ISBN-0-85679-232-2) For information on availability of series, sub series, and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161 HC E99

The thermal resistance is estimated between a bearing surface and the environment in order to determine the equilibrium temperature at the bearing surface, or at other locations in a bearing assembly. Typical applications include all types of machinery, from domestic appliances to spacecraft mechanisms. ESDU

N79-25391 Brigham Young Univ., Provo, Utah.
COMPUTER CONTROLLED DYNAMIC TESTS WITH MOTORING OF AN INTERNAL COMBUSTION ENGINE WITH ALTERNATE FUELS Ph.D. Thesis
Geoffrey James Germane 1978 190 p
Avail: Univ. Microfilms Order No. 7911892

A computer controlled and monitored internal combustion engine test cell with motoring is described. A control scheme for the engine and dynamometer for a simulated vehicle with gear shifting is presented. A comparison of dynamic and steady state engine tests is made. An evaluation of alternate fuels is made from the results of two different driving cycles, one with transmission shifting and motoring and the other with only gear shifting. Experimental data, from the dynamic tests, which show a difference in brake thermal efficiency and exhaust emissions for ethanol-gasoline and methanol-gasoline mixtures compared with straight gasoline, is presented. Dissert. Abstr.

N79-25392*# Mechanical Technology, Inc., Latham, N. Y.
T700 POWER TURBINE ROTOR MULTIPLANE/ MULTISPEED BALANCING DEMONSTRATION
G. Burgess and R. Rio Feb. 1979 45 p refs
(Contract NAS3-18520)
(NASA-CR-159586; MIT-79-TR-29) Avail: NTIS HC A03/MF A01 CSCL 20E

Research was conducted to demonstrate the ability of influence coefficient based multispeed balancing to control rotor vibration through bending criticals. Rotor dynamic analyses were conducted of the General Electric T700 power turbine rotor. The information was used to generate expected rotor behavior for optimal considerations in designing a balance rig and a balance technique. The rotor was successfully balanced 9500 rpm. Uncontrollable coupling behavior prevented observations through the 16,000 rpm service speed. The balance technique is practical and with additional refinement it can meet production standards. Author

N79-25393# National Inst. for Telecommunications Research, Johannesburg (South Africa).
CONVERTING THE STANDARD INTERNAL COMBUSTION ENGINE TO RUN ON HYDROGEN
W. J. Botha [1979] 7 p Presented at the Symp. on Alternative Motor Fuels, Johannesburg, 1974
Avail: NTIS HC A02/MF A01

A 1,000 cc Mazda Bakkie was converted to run on bottled hydrogen using commercially available components. The engine was not modified but used in its standard form. The serious inlet manifold back-burn and back-firing problems were cured by recirculation of a portion of the inert exhaust gases. The result was a somewhat under powered, but driveable vehicle with a range of 30 km on one high pressure cylinder containing 0.52 kg of hydrogen. No attempt was made to solve the hydrogen storage problem or determine engine wear. R.E.S.

N79-25394*# National Aeronautics and Space Administration, Washington, D. C.
PENETRATORS (PENETRATING SONDES) AND NEW POSSIBILITIES FOR STUDY OF THE PLANETS
V. D. Davydov and G. A. Skuridin May 1979 23 p refs Transl. into ENGLISH of "Penetratory (Pronikayushchiye Zondy) i Novyye Vozmozhnosti Issledovaniya Planet", Rept. Pr-419 Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1978 p 1-24 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75626; Pr-419) Avail: NTIS HC A02/MF A01 CSCL 20K

The fields of possible use of penetrators in space research are considered. A survey of the condition of development and plans for use of penetrators abroad is presented and an analysis is given of the significance of scientific problems when probing planets. Author

N79-25395*# Oak Ridge National Lab., Tenn.
USER'S MANUAL FOR PRESTO: A COMPUTER CODE FOR THE PERFORMANCE OF REGENERATIVE STEAM TURBINE CYCLES
L. C. Fuller and T. K. Stovall Jun. 1979 93 p refs
(NASA Order C-10669-D; Contracts W-7405-eng-26; DOE-40-666-77)
(NASA-CR-159540; ORNL-5547) Avail: NTIS HC A05/MF A01 CSCL 13I

Standard turbine cycles for baseload power plants and cycles with such additional features as process steam extraction and induction and feedwater heating by external heat sources may be modeled. Peaking and high back pressure cycles are also included. The code's methodology is to use the expansion line efficiencies, exhaust loss, leakages, mechanical losses, and generator losses to calculate the heat rate and generator output. A general description of the code is given as well as the instructions for input data preparation. Appended are two complete example cases. R.E.S.

N79-25396# Rockwell International Corp., Canoga Park, Calif. Rocketdyne Div.
INTEGRATED POWER UNIT Final Report, 16 Apr. 1976 - 31 Jul. 1978
G. S. Wong, T. I. Yu, J. J. Ward, R. L. Binsley, and J. A. Williams Dec. 1978 253 p
(Contract F33615-76-C-2054; AF Proj. 3145)
(AD-A066543; RI/RD78-237; AFAPL-TR-78-98) Avail: NTIS HC A12/MF A01 CSCL 21/5

Results of a development program for an Integrated Power Unit (IPU) combining the functions of the Accessory Power Units (APU) and Emergency Power Units (EPU) for the aircraft are presented. The design and testing of two gas generators using gaseous oxygen (GOX) and JP-4 propellants are discussed. Subsequent design and test results for an IPU engine starter demonstrator that used one of the gas generators are also presented. GRA

N79-25397# Virginia Univ., Charlottesville. Dept. of Mechanical and Aerospace Engineering.
HIGH SPEED ROTOR BALANCING Final Report, 21 Oct. 1977 - 30 Nov. 1978
Walter D. Pilkey Dec. 1978 14 p refs
(Grant DAAG29-78-G-0019)
(AD-A067221; UVA/525088/MAE78/102; ARO-15080.7-E) Avail: NTIS HC A02/MF A01 CSCL 13/9

This report summarizes the accomplishments of the final year of a study exploring new methods for balancing, analyzing and designing flexible rotating shafts. A technique for identifying

rotor bearing parameters is proposed. Then a quadratic programming formulation is presented for influence coefficient balancing with constraints. Finally, a method is developed for determining the optimal axial location of balancing planes. Author (GRA)

N79-25398# National Centre of Tribology, Risley (England). European Space Tribology Lab.
THERMAL VACUUM QUALIFICATION TESTS, ACCELERATED LIFE TESTS AND STRIPDOWN OF AN MSDS QUALIFICATION MODEL ANTENNA POINTING MECHANISM
J. C. Anderson Paris ESA Jun. 1978 89 p refs
(Contract ESTEC-2713/76-NI-MD)
(ESA-ESTL-036; ESA-CR(P)-1145) Avail: NTIS HC A02/MF A01

A qualification model antenna pointing mechanism was tested under thermal vacuum conditions. During initial qualification testing, the errors of pointing at four specified temperature conditions were derived from optical measurements of angular rotation about the X and Y axes. The mechanism was then subjected to a six-month accelerated life test during which each axis in turn was continuously cycled over + or - 1 deg of rotation at each of four temperature conditions. The qualification tests were then repeated and the mechanism was dismantled. The tests show that the mechanism operates satisfactorily under vacuum at all four temperature conditions and survives an accelerated life test with negligible wear on its moving parts.
Author (ESA)

N79-25399# National Centre of Tribology, Risley (England). European Space Tribology Lab.
EXPERIMENTS ON THE TORQUE OF BALL BEARINGS OVER SMALL ANGLES OF MOVEMENT
K. T. Stevens and M. J. Todd Paris ESA 1978 29 p refs
(Contract ESTEC-2584/75-MD)
(ESA-ESTL-34; ESA-CR(P)-1147) Avail: NTIS HC A02/MF A01

The torque of ball bearings moving over small angles (from about 0.01 to 1.5 deg of arc) is of relevance to attitude control and pointing systems on spacecraft. With sensitive transducers to register both inner and outer race movements, the magnitude of bearing torque against angle was measured for bearings with both oil and solid-film lubrication. Measurements show a predominantly elastic hysteresis behavior at low angles and also reveal evidence of some adhesion at the extremities of the oscillatory motion with the solid-film lubricants, but not with the liquid lubricants. However, the adhesion is small enough to permit the torque/displacement relation proposed by Dahl to fit both liquid and dry lubricant cases reasonably well up to the point of steady rolling. Though not easy to determine accurately, this point occurred at angles from 0.3 to 0.75 deg with no clear correlation with the type of lubrication. Author (ESA)

N79-25400# Southwest Research Inst., San Antonio, Tex.
UNIFORM TIRE QUALITY GRADING TREADWEAR COURSE MONITORING 4 Final Report, Jun. 1976 - Sep. 1977
Richard N. Pierce Oct. 1978 339 p refs
(Contract DOT-HS-6-01348)
(PB-292183/1; DOT-HS-803-801) Avail: NTIS HC A15/MF A01 CSCL 13F

A 400 mile road test course over public highways in the vicinity of San Angelo, Texas was used to evaluate candidate course monitoring tires for the treadwear requirement of the uniform tire grading program. The testing was conducted in 33 successive convoys of three cars each. Measurements of the individual tires were taken at 800 mile increments. The resultant tread wear rates for each tire and the related projected mileage estimates are presented in this report with details of the test conduct and processes. GRA

N79-25401# ENSCO, Inc., Alexandria, Va. Engineering Testing and Analysis Div.
PASSENGER VEHICLE BRAKING STUDY Technical Report, Dec. 1977 - May 1978
J. Serocki and R. Scofield May 1978 84 p refs
(Contract DOT-FR-64113)
(PB-292650/9; FRA/ORD-78/33; DOT/FR-78/30) Avail: NTIS HC A05/MF A01 CSCL 13F

Currently available brake components and braking systems that might be applicable to 150-mph passenger service were summarized. An analysis of the braking problem, a description of braking systems now in use and an evaluation of several advanced braking systems were included. Whether or not eddy-current brakes should be developed for use on Amcoaches and/or Metroliners in high-speed service in the Northeast Corridor was reviewed. This report also considered what systems or components should be developed in the event that eddy-current brakes prove unusable. GRA

N79-25402# Calspan Corp., Buffalo, N. Y.
EQUILIBRIUM AND TRANSIENT ROLLING RESISTANCE OF TRUCK TIRES MEASURED ON CALSPAN'S TIRE RESEARCH FACILITY Final Report, Nov. 1977 - May 1978
I. Gusakov, G. A. Tapia, and L. Bogdan Jan. 1979 137 p refs
(Contract DOT-OS-60156)
(PB-292289/6; CALSPAN-ZM-5947-T-2) Avail: NTIS HC A07/MF A01 CSCL 13F

The tire sample included both radial-ply and bias-ply tires in four of the most popularly used sizes: 9.00-20/F, 10.00-20/G, 9.00R20/F, and 11522.5/G. Tests were conducted to measure rolling resistance sensitivity to variations in speed, load, inflation pressure and torque with the tire in both equilibrium and nonequilibrium states. Rolling resistance measurements (free-rolling) were made on both a flat roadway and a 67.23-inch diameter drum. A short description of the test program and a summary of the results are included. GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N79-25403 Stanford Univ., Calif.
PROBABILISTIC FAULT DIAGNOSIS MODELS FOR DIGITAL SYSTEMS Ph.D. Thesis
Marion Lee Blount 1979 204 p
Avail: Univ. Microfilms Order No. 7912345

Two diagnosis models are presented for calculating the probability of correct system diagnosis. This calculated measure can be used to determine the coverage for the system and the availability of the system. The two models are intended for use in the distinct cases in which the final fault status decision is made by an entity internal to the system or external to the system. A procedure for calculating a set of conditional probabilities that establishes a probabilistic relationship between the tests of the system and the underlying fault condition are reported. These conditional probabilities are used by procedures that calculate the diagnosability measures and generate the optimal diagnosis processes. Dissert. Abstr.

N79-25404# California Univ., Berkeley. Operations Research Center.
COMPUTER-AIDED FAULT TREE ANALYSIS Research Report
Randall R. Willie Aug. 1978 104 p refs
(Contract N00014-75-C-0781; Grant AF-AFOSR-3179-77)
(AD-A066567; ORC-78-14) Avail: NTIS HC A06/MF A01 CSCL 09/2

Part I of this report discusses a computer-oriented methodology for deriving minimal cut and path set families associated with arbitrary fault trees. Part II describes the use of the Fault Tree Analysis Program (FTAP), an extensive FORTRAN computer package that implements the Part I methodology. An input fault tree to FTAP may specify the system state as any logical function of subsystem or component state variables or complements of these variables. When fault tree logical relations involve complements of state variables, the analyst may instruct FTAP to produce a family of prime implicants, a generalization of the minimal cut set concept. FTAP can also identify certain subsystems associated with the tree as system modules and provide a

collection of minimal cut set families that essentially expresses the state of the system as a function of these modules state variables. Another FTAP feature allows a subfamily to be obtained when the family of minimal cut sets of prime implicants is too large to be found in its entirety; this subfamily consists only of sets that are interesting to the analyst in a special sense.
Author (GRA)

N79-25405# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
QUALITY CONTROL DURING HOT AND COLD WEATHER CONCRETING Final Report
John M. Scanlon Jan. 1979 27 p refs Presented at the Educational Symp. on Hot and Cold Weather Concreting, Kansas City, Mo., 29 Nov. - 1 Dec. 1978
(AD-A066989; WES-MP-SL-79-4; QTIAC-36) Avail: NTIS HC A03/MF A01 CSCL 11/2

Construction quality management, including the roles and responsibilities of the various participants, in hot and cold weather concreting is discussed. Procedures for overcoming problems during unusual weather conditions and the importance of good quality control are emphasized. Anticipation of various problems to be expected during hot and cold weather is discussed and recommendations on how to alleviate these problems are presented. Author (GRA)

N79-25406# SRI International Corp., Menlo Park, Calif.
MICROWAVE TECHNIQUES FOR NONDESTRUCTIVE EVALUATION OF CERAMICS, PHASE 2 Final Report, 30 Jun. 1976 - 9 Dec. 1978
Alfred J. Bahr Feb. 1979 87 p refs
(Contract DAAG46-76-C-0048)
(AD-A067078; AMMRC-TR-79-9) Avail: NTIS HC A05/MF A01 CSCL 14/2

The ability of microwave energy to penetrate some kinds of ceramic materials at frequencies of 100 GHz and higher suggests that microwave techniques may be useful for the nondestructive evaluation (NDE) of such materials. The work described in this report demonstrates the basic feasibility of these techniques for detecting and locating various types of inclusions (including voids) in seeded plates of Si3N4. Inclusions as small as 0.005 inch in diameter have been detected using frequencies near 100 GHz. Microwave cross-polarized C-scan images of inclusions have been obtained with a resolution of about one wavelength (3 mm). Some of these images exhibit distinguishing features for different types of flaws. Various practical aspects that affect the ultimate utility of microwave NDE for ceramics are also discussed.
Author (GRA)

N79-25407# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
METHODOLOGY FOR CONTROL OF LIFE CYCLE COSTS FOR AVIONICS SYSTEMS
Apr. 1979 150 p refs Lectures presented at Bonn, 7-8 May 1979 and Athens, 10-11 May 1979
(AGARD-LS-100; ISBN-92-835-1321-5) Avail: NTIS HC A07/MF A01

Various aspects of life cycle costs as relating to airborne equipment are presented. Included are: the model of a Canadian microtacan, research on the reliability of the systems, and methods for the control of the costs. For individual titles, see N79-25408 through N79-25411.

N79-25408# General Research Corp., Santa Barbara, Calif.
LIFE CYCLE COST ANALYSIS CONCEPTS AND PROCEDURES
Edward N. Dodson *In* AGARD Methodology for Control of Life Cycle Costs for Avionics Systems Apr. 1979 28 p refs (For primary document see N79-25407 16-38)
Avail: NTIS HC A07/MF A01

The principles and procedures of parametric cost analysis based upon aggregate relationships between cost and the physical/performance characteristics of high technology equipment are presented. M.M.M.

N79-25409# Bell-Northern Research Ltd., Ottawa (Ontario). Contract Reliability Engineering.
THE DEVELOPMENT AND IMPLEMENTATION OF LIFE CYCLE COST METHODOLOGY
T. D. Kiang *In* AGARD Methodology for Control of Life Cycle Costs for Avionics Systems Apr. 1979 25 p refs (For primary document see N79-25407 16-38)
Avail: NTIS HC A07/MF A01

The concepts of the life cycle management and the life cycle costing process suitable for the Canadian Forces environments are presented. The features of the life cycle management cost model and its capability to relate cost and system effectiveness factors are discussed. The results of the model application to the AN/ARN-504 microtacan are presented. M.M.M.

N79-25410# Rome Air Development Center, Griffiss AFB, N.Y.
RECENT EXPERIENCE IN THE DEVELOPMENT AND APPLICATION OF LCC MODELS
Jerome Klion and Anthony Coppola *In* AGARD Methodology for Control of Life Cycle Costs for Avionics Systems Apr. 1979 150 p refs (For primary document see N79-25407 16-38)
Avail: NTIS HC A07/MF A01

A description of various models which incorporate acquisition costs and operation support costs as they apply to avionics procurements are presented. The methods by which the models are developed along with their shortcomings and sensitivities are reported. M.M.M.

N79-25411# Ministry of Defence, London (England).
PROBLEMS IN THE INVESTIGATION OF RELIABILITY-ASSOCIATED LIFE-CYCLE COSTS OF MILITARY AIRBORNE SYSTEMS
P. G. Reich *In* AGARD Methodology for Control of Life Cycle Costs for Avionics Systems Apr. 1979 21 p refs (For primary document see N79-25407 16-38)
Avail: NTIS HC A07/MF A01

The problems of deriving improved control of the life cycle costs that are associated with reliability are discussed as well as the relationships between the many possible sorts of investment resulting in better reliability and maintainability and the benefits it achieves. Considered are the difficulty in overcoming data acquisition, and the methodology for handling the complex properties of reliability and maintainability of airborne weapons systems. M.M.M.

N79-25412# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
NON-DESTRUCTIVE INSPECTION METHODS FOR PROPULSION SYSTEMS AND COMPONENTS
Apr. 1979 70153 p refs In ENGLISH and partly in FRENCH Lecture series held at London, 23-24 Apr. 1979 and Milan, 26-27 Apr. 1979
(AGARD-LS-103; ISBN-92-835-0237-X) Avail: NTIS HC A08/MF A01

The state-of-the-art and the foreseeable or hoped progress of the nondestructive inspection methods applied to the turbine and pistons engine are examined and discussed. The following topics are discussed: (1) nondestructive inspection of aircraft engines; (2) high resolution radiography in the aero-engine industry; (3) wear debris analysis; (4) high resolution ultrasonic nondestructive testing of complex geometry components; (5) nondestructive methods for the early detection of fatigue damage in aircraft components; (6) in situ inspection of electron beam weld by acoustic emission; and (7) broadband ultrasonic transducers for nondestructive inspection of aeronautical components. For individual titles, see N79-25413 through N79-25419.

N79-25413# General Electric Co., Cincinnati, Ohio.
STATE-OF-THE-ART OF NONDESTRUCTIVE INSPECTION OF AIRCRAFT ENGINES
D. M. Comassar *In* AGARD Non-destructive Inspection Methods for Propulsion Systems and Components Apr. 1979 12 p refs (For primary document see N79-25412 16-38)
Avail: NTIS HC A08/MF A01

There are five basic nondestructive inspection disciplines which are more commonly applied to engine components, namely ultrasonic, eddy current, fluorescent penetration, radiographic and magnetic particle inspection. There are a number of recent advancements in the ultrasonic and eddy current processes as well as improvements in the fluorescent penetration process.

These are discussed. These advancements are primarily in the equipment area and in the automation of the inspection process. The discussion focuses on improvements in the ultrasonic, eddy current and fluorescent penetration processes. Several nonconventional techniques used for inspection of development hardware are also discussed. G.Y.

N79-25414# Atomic Energy Research Establishment, Harwell (England). Material Physics Div.
HIGH RESOLUTION RADIOGRAPHY IN THE AERO-ENGINE INDUSTRY
R. W. Parish *In* AGARD Non-Destructive Inspection Methods for Propulsion Systems and Components Apr. 1979 38 p refs (For primary document see N79-25412 16-38)
Avail: NTIS HC A08/MF A01

Microfocal X-ray equipment which in certain circumstances can achieve considerably enhanced resolution is discussed and emphasis is placed on the application of these small X-ray sources to aero-engine components. These techniques allow small defects to be resolved which hitherto were undetectable when using conventional X-ray techniques. G.Y.

N79-25415# Royal Aircraft Establishment, Farnborough (England).
WEAR DEBRIS ANALYSIS
N. L. Parr and J. Ritchie *In* AGARD Non-Destructive Inspection Methods for Propulsion Systems and Components Apr. 1979 20 p refs (For primary document see N79-25412 16-38)
Avail: NTIS HC A08/MF A01

Factors controlling the cost of ownership of expensive military equipment are outlined with specific reference to the role of wear on scheduled and unscheduled maintenance. The value and limitations of established condition monitoring techniques and procedures are explored for engine, gearbox and hydraulic systems. An account is given of current effort to improve these techniques and of research to evolve meaningful monitoring measures for a more scientific approach to the development and operation of new machinery incorporating advanced engineering designs and materials. An idealized research and development, centered on gear profile failure demonstrator facilities, including a number of supporting scientific, technological and design exercises, is presented. G.Y.

N79-25416# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
HIGH RESOLUTION ULTRASONIC NONDESTRUCTIVE TESTING OF COMPLEX GEOMETRY COMPONENTS
T. J. Moran *In* AGARD Non-Destructive Inspection Methods for Propulsion Systems and Components Apr. 1979 6 p refs (For primary document see N79-25412 16-38)
Avail: NTIS HC A08/MF A01

Research in ultrasonic nondestructive inspection methods in the USA has undergone a major change in philosophy in the last four years. Previous emphasis was on the detection of flaws, while present work concentrates on the characterization of the flaw and the material state. The background of events leading to this change are discussed. Along with the change in direction of research, developments efforts concentrated on improving the reliability of the detection of defects. Major programs were directed toward the goal of a completely automated ultrasonic inspection system which would effectively remove the human factor. Several systems which were designed for the inspection of complex shapes are described. G.Y.

N79-25417# Johns Hopkins Univ., Baltimore, Md. Dept. of Mechanics and Materials Science.
NON-DESTRUCTIVE METHODS FOR THE EARLY DETECTION OF FATIGUE DAMAGE IN AIRCRAFT COMPONENTS
Robert E. Green, Jr. *In* AGARD Non-Destructive Inspection Methods for Propulsion Systems and Components Apr. 1979 31 p refs (For primary document see N79-25412 16-38)
Avail: NTIS HC A08/MF A01

The various nondestructive techniques which are used or which are potentially useful for detection of fatigue damage in aircraft components are described and discussed. Included among the nondestructive techniques which are considered are radiography, penetrant inspection, eddy current, ultrasonics, acoustic emission, magnetic particle and Barkhausen noise analysis, and more exotic techniques such as exoelectron emission, positron annihilation, and other atomic, nuclear, or solid state physics reactions. G.Y.

N79-25418# Centre Technique des Industries Mecaniques, Senlis (France).
IN SITU INSPECTION OF ELECTRON BEAM WELD BY ACOUSTIC EMISSION
P. F. Dumosseau *In* AGARD Non-Destructive Inspection Methods for Propulsion Systems and Components Apr. 1979 14 p refs In FRENCH; ENGLISH summary (For primary document see N79-25412 16-38)
Avail: NTIS HC A08/MF A01

Acoustic emission applicability to nondestructive inspection, particularly to welding control, is discussed. A general presentation of the technique emphasizes instrumentation and signal processing aspects. Advantages and disadvantages are discussed. Experimental work performed to check feasibility of applying this control to welding of gas turbine components is detailed. Emissive behavior of various materials is considered referring to their crack suspectability. It concerns annealed steel, stainless steels, titanium alloys, and Inconel 718. Results of tests conducted on linear and circular welds of specimens and real components are presented and discussed. The practical problems involved in industrial application are considered. G.Y.

N79-25419# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
BROAD-BAND TRANSDUCERS FOR NONDESTRUCTIVE INSPECTION OF AERONAUTICAL COMPONENTS
Jean-Francois deBelleval *In* AGARD Non-Destructive Inspection Methods for Propulsion Systems and Components Apr. 1979 10 p refs In FRENCH; ENGLISH summary (For primary document see N79-25412 16-38)
Avail: NTIS HC A08/MF A01

For ultrasonic nondestructive inspection of aeronautical components, it is mandatory to detect defects both smaller and smaller, and nearer and nearer the surface of these components. The quantitative evaluation of these defects, allowing a definition of their mechanical consequences, must also be improved. This requires the use of more sensitive ultrasonic transducers, with a larger bandwidth. The main method used at present to increase the bandwidth of piezoelectric transducers entails an important decrease of their sensitivity: it is based on the damping of the piezoelectric wafer on its rear face. Suggested to use instead damping by a multilayer front face, which allows a simultaneous increase of both sensitivity and bandwidth. In order to study the feasibility of this process, a computing program was developed to calculate the propagation of a wave through several layers of different thicknesses. This program makes it possible to optimize the characteristics (impedance and thickness) of the various layers making up the transducer. Comparisons with actual transducers allowed the validation of this theoretical model. G.Y.

N79-25108*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MATHEMATICAL MODEL FOR PREVENTIVE MAINTENANCE SCHEDULING
G. Lorden and D. S. Remer *In its* The Deep Space Network 15 Jun. 1979 p 144-149 refs (For primary document see N79-25088 16-12)
Avail: NTIS HC A11/MF A01 CSCL 14D

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N79-25420 Houston Univ., Tex.
DYNAMIC STABILITY AND IMPROVED LOWER BOUNDS FOR FREQUENCIES AND BUCKLING LOADS OF INITIALLY COMPRESSED BEAMS Ph.D. Thesis
Shady Youssef Hanna 1978 79 p

Avail: Univ. Microfilms Order No. 7912827

The boundaries of the principal region of instability and upper bounds of the natural frequencies of initially compressed beams are investigated. Beams under distributed compression, such as the beam's weight or inertia loading due to longitudinal acceleration are considered as well as beams subjected to concentrated loads. Numerical results are considered for beams having hinged-hinged, fixed-fixed, free-free, fixed-hinged, and fixed-free end conditions. Dissert. Abstr.

N79-25421 Carnegie-Mellon Univ., Pittsburgh, Pa.
SIXTH ORDER ANALYSIS OF CLOSURE IN A CRACKED, ELASTO-PLASTIC PLATE Ph.D. Thesis
Francis Sylvester Heming, Jr. 1979 154 p
Avail: Univ. Microfilms Order No. 7911927

The bending of a plate containing a centrally located, through crack is analyzed. Results are obtained numerically via a finite element analysis based on the assumptions of Mindlin sixth order plate theory, which admits three boundary conditions of any point and includes the effects of transverse shear. Elastic and elasto-plastic results are presented for two cases, one that includes the effects of closure and one that does not. The influence of closure on the local displacements, stress distributions, bending stress intensity factors, crack tip blunting, and the growth of the plastic enclave is demonstrated. The effect of thickness and the significance of transverse shear is discussed. It was concluded that boundary conditions are critical to the modelling process, and the effects of closure are significant and must be included when demanded by the actual physical situation. Dissert. Abstr.

N79-25422# Kyushu Inst. of Tech., Kitakyushu (Japan).
THE ON-SITE INDICATION OF DAMAGE UNDER COMPLEX LOAD BY USING A MICROCOMPUTER
H. Anzai and T. Endo 1978 31 p refs Presented at SEECO '78, Intern. Conf. on Appl. of Computers in Fatigue, Warwick Univ., Engl.
(ICAF-1079) Avail: NTIS HC A03/MF A01

A fatigue damage indicator using a microcomputer is reported. The evaluation of damage was based on the rainflow algorithm, the S/N relation and the linear damage rule. Real time, on-site fatigue damage evaluation was achieved by the investigation of a digital system oriented rainflow algorithm, by the adoption of an input buffer, and by the use of a table where the result of calculation of fatigue damage per reversal of strain is stored. A hard-wired logic for the rainflow algorithm was established and was simulated by the microcomputer of Motorola MC6800. Multichannel monitoring and its applications to cross analysis are briefly discussed. J.A.M.

N79-25423*# Martin Marietta Corp., Denver, Colo.
THE USE OF COHERENCE FUNCTIONS TO DETERMINE DYNAMIC EXCITATION SOURCES ON LAUNCH VEHICLE PAYLOADS Technical Report, May 1977 - May 1978
Stanley Barrett and Robert M. Halvorson Washington NASA Jun. 1979 78 p refs
(Contract NAS1-14370)
(NASA-CR-3142; MCR-78-556) Avail: NTIS HC A05/MF A01 CSCL 20K

The problem of determining the relative contribution of simultaneous acoustic and mechanical inputs to the response of structures under combined dynamic loads was studied. An analytical technique developed by Bendat for calculating ordinary, partial, and multiple coherence functions, using an iterative nonmatrix approach was applied to data obtained from laboratory tests on a complex structural assembly. Testing was performed in an acoustically 'live' room. Up to three random inputs, having similar spectral content and varying degrees of mutual coherence, and a single output were used. Stationary and nonstationary inputs were used. It was concluded that the technique provided an effective method of identifying sources of dynamic excitation and evaluating their relative contributions to the measured output at structural resonances, for stationary random inputs. An attempt to apply the technique to nonstationary inputs did not yield consistent results. Author

N79-25424*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
SUPERPLASTICALLY FORMED DIFFUSION BONDED METALLIC STRUCTURE Patent Application
William L. Ko, inventor (to NASA) Filed 30 May 1979 16 p (NASA-Case-FRC-11026-1; US-Patent-Appl-SN-043944) Avail: NTIS HC A02/MF A01 CSCL 20K

A pair of core plates formed of a superplastic alloy are interposed between the base plate and the cover plate in a sandwich relationship. Each of the core plates are characterized by a plurality of protrusions of square-based, truncated pyramids. These pyramids are uniformly aligned along orthogonally related axes which perpendicularly bisect the legs of the bases of the pyramids. The pyramids are also alternatively inverted along orthogonally related planes which diagonally bisect the pyramids. Thus, an orthogonally corrugated core is provided.
NASA

N79-25425*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
FOLDABLE BEAM Patent Application
John M. Hedgepeth (Astro Research Corp., Carpinteria, Calif.), John V. Coyner (Astro Research Corp., Carpinteria, Calif.), and Robert F. Crawford, inventors (to NASA) (Astro Research Corp., Carpinteria, Calif.) Filed 23 Feb. 1979 15 p Sponsored by NASA
(NASA-Case-LAR-12077-1; US-Patent-Appl-SN-014663) Avail: NTIS HC A02/MF A01 CSCL 20K

The invention is used in cases where a conventional solid beam is unsuitable, specifically where transportation to the use site requires a more lightweight or compact structure. Ease of deployment is another object. Construction of antennae or platforms in outer space is such a case. The novelty of the invention lies in the use of hinged segments in conjunction with cables, whereby a collapsed assembly of lightweight tublar struts may be readily deployed simply by applying tension to the cables, and just as easily stowed by loosening the cables.
Official Gazette of the U.S. Patent and Trademark Office

N79-25426*# Rockwell International Corp., Los Angeles, Calif. Aircraft Div.
DETERMINATION OF SUBCRITICAL FREQUENCY AND DAMPING FROM B-1 FLIGHT FLUTTER TEST DATA Final Report
S. K. Dobbs and C. H. Hodson Jun. 1979 87 p refs
(Contract NAS4-2278)
(NASA-CR-3152) Avail: NTIS HC A05/MF A01 CSCL 01C

The application of the time-lag products correlation/frequency analysis procedure to determine subcritical frequency and damping from structural response measurements made during flight flutter test of the B-1 prototype airplane is described. The analysis procedure, the test airplane, and flight test procedures are discussed. Summary frequency and damping results are presented for six transonic flight conditions. Illustrative results obtained by applying various options and variations of the analysis method are included for one flight condition. A.R.H.

N79-25427*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
APPROXIMATION METHODS FOR COMBINED THERMAL/STRUCTURAL DESIGN
Raphael T. Haftka (Illinois Inst. of Tech.) and Charles P. Shore Jun. 1979 35 p refs
(NASA-TP-1428; L-12674) Avail: NTIS HC A03/MF A01 CSCL 20K

Two approximation concepts for combined thermal/structural design are evaluated. The first concept is an approximate thermal analysis based on the first derivatives of structural temperatures with respect to design variables. Two commonly used first-order Taylor series expansions are examined. The direct and reciprocal expansions are special members of a general family of approximations, and for some conditions other members of that family of approximations are more accurate. Several examples are used to compare the accuracy of the different expansions. The second approximation concept is the use of critical time points for combined thermal and stress analyses of structures with transient loading conditions. Significant time savings are realized by identifying critical time points and performing the stress analysis for those points only. The design of an insulated panel which is exposed to transient heating conditions is discussed. M.M.M.

N79-25428# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
USER'S GUIDE: COMPUTER PROGRAM WITH INTERACTIVE GRAPHICS FOR ANALYSIS OF PLANE FRAME STRUCTURES (CFRAME) Final Report
Joseph P. Hartman and John J. Jobst Mar. 1979 60 p
(AD-A067349; WES-INSTRUCTION-0-79-2) Avail: NTIS HC A04/MF A01 CSCL 13/13

This report documents the usage of the general purpose computer program CFRAME for the analysis of plane frame structures. The intent was to develop an easy-to-use program incorporating the best features of many similar programs and to provide the many additional capabilities required by a diverse group of users. CFRAME utilizes the stiffness methods of structural analysis. The Cholesky decomposition method is used to solve the resulting matrix equation. Automatic generation routines are available to simplify the data input. Graphical display of this input data is also available. The output may be printed or displayed with graphics. Author (GRA)

N79-25429# Weidlinger Associates, Menlo Park, Calif.
TRANSIENT ANALYSIS OF EQUIPMENT-STRUCTURE INTERACTION AT HIGH FREQUENCIES Final Report, Sep. 1977 - May 1978
J. L. Sackman and J. M. Kelly May 1978 66 p refs
(Contract DNA001-77-C-0233)
(AD-A066607; R-7828; DNA-4675F) Avail: NTIS HC A04/MF A01 CSCL 13/13

An analytical method is developed which yields a simple estimate of the maximum dynamic response of light equipment attached to a structure subjected to ground motions. The natural frequency of the equipment, modeled as a single-degree-of-freedom system, is considered to be close, or equal, to one of the natural frequencies of the N-degree-of-freedom structure. This bound provides a convenient rational method for the structural design of the equipment and its installation. The approach is based on the transient analysis of lightly damped, tuned or detuned equipment-structure systems in which the mass of the equipment is small in comparison with that of the structure. It is assumed that the information available to the designer is a design spectrum for the ground motion and fixed-base modal properties of the structure alone and of the equipment alone. The results obtained are estimates of the maximum acceleration and displacement of the equipment in terms of this information. The method can also be used to treat closely-spaced modes in structural systems, where the conventional square root of the sum of squares procedure is known to be invalid. GRA

N79-25430# Pennsylvania Univ., Philadelphia. Dept. of Materials Science and Engineering.
FATIGUE FAILURE CRITERIA FOR COMBINED CYCLIC STRESS
Zvi Hashin 1 Mar. 1979 22 p refs
(Contract N00014-78-C-0544)
(AD-A066458; TR-2) Avail: NTIS HC A02/MF A01 CSCL 20/11

Failure criteria for combined cyclic stress are represented in terms of parametric families of failure surfaces in stress space. Quadratic approximations and symmetry arguments are employed in systematic fashion to construct isotropic failure criteria for general three dimensional states of cyclic stress. Particular attention has been directed to the important cases of normal stress-shear stress (bending-torsion) and biaxial stress cyclings. It is shown that failure criteria for cycling with and without mean stress (reversed cycling) have different forms, the latter admitting simpler representations. Author (GRA)

N79-25431# Pennsylvania Univ., Philadelphia. Dept. of Materials Science and Engineering.
A REINTERPRETATION OF THE PALMGREN-MINER RULE FOR FATIGUE LIFE PREDICTION
Zvi Hashin 15 Jan. 1979 25 p refs
(Contract N00014-78-C-0544)
(AD-A066457; TR-1) Avail: NTIS HC A02/MF A01 CSCL 20/11

It is shown that the simple Palmgren-Miner linear cumulative damage rule is a special case of a general cumulative damage theory previously established. Predictions of lifetimes for families of multistage loadings according to the Palmgren-Miner rule and the general cumulative damage theory are compared with the aim of arriving at qualitative guidelines for applicability of the Palmgren-Miner rule in cyclic loading programs. Author (GRA)

N79-25432# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.
FINITE ELEMENT ANALYSIS OF CREEP AND THREE DIMENSIONAL FRACTURE Final Report, 15 Mar. 1977 - 14 Oct. 1978
Theodore H. H. Pian and Sung Won Lee Dec. 1978 41 p refs
(Contract F49620-77-C-0084; AF Proj. 2307)
(AD-A066753; ASRL-TR-191-2; AFOSR-79-0346TR) Avail: NTIS HC A03/MF A01 CSCL 20/11

Assumed stress hybrid finite element methods are developed for linear fracture analysis of three dimensional solids and for fracture of metals under high temperature creep conditions. For the 3-D fracture analysis a series of special elements with hexagonal shape have been derived. These elements include the asymptotic singular behavior at the crack tip front. For the fracture analysis of metals at high temperature, a method has been developed to analyze plane problems with growing cracks. From a comprehensive literature survey made for both analytical and experimental studies of crack growth under creep conditions, it is concluded that a possible numerical method is to incorporate the concept of damage parameter by Kachanov. Preliminary development in incorporating such parameter in the finite element creep analysis has been made. Author (GRA)

N79-25433# Boeing Co., Wichita, Kans.
THE INFLUENCE OF FLEET VARIABILITY ON CRACK GROWTH TRACKING PROCEDURES FOR TRANSPORT/BOMBER AIRCRAFT Final Technical Report, 1 Nov. 1976 - 1 Jun. 1978
David F. Bryan and Gordon E. Lambert Nov. 1978 208 p refs
(Contract F33615-76-C-3130)
(AD-A066596; AFFDL-TR-78-158) Avail: NTIS HC A10/MF A01 CSCL 01/3

The purpose of this program is to provide generalized crack growth tracking procedures for transport/bomber aircraft. The study was composed of three major tasks, (1) an evaluation of the effects of usage parameters on crack growth, (2) the development of generalized tracking procedures and (3) an evaluation of the techniques for implementing the individual aircraft tracking program. The KC-135A tanker was selected as the baseline aircraft for this study. Approximately thirty tests were conducted to experimentally verify predictions made from analyses and to determine the crack growth rate characteristics of the specimen material. The results of the parametric and variability studies were used to develop analysis schemes for predicting the effects of usage variations on crack growth. Four tracking procedures were evaluated: (1) pilot logs with the use of parametric crack growth rate data, (2) pilot logs with the use of parametric stress exceedance data, (3) the Mechanical Strain Recorder (MSR) and (4) the crack growth gauge. The implementation of each tracking procedure was evaluated by developing a cost model to study relative life cycle costs. Author (GRA)

N79-25434# California Univ., Berkeley. Dept. of Engineering.
ON THERMAL EFFECTS IN THE THEORY OF RODS
A. E. Green and P. M. Naghdi Feb. 1979 55 p refs
(Contract N00014-75-C-0148; NR Proj. 064-436)
(AD-A066951; UCB/AM-79-2) Avail: NTIS HC A04/MF A01 CSCL 20/11

This paper is concerned with thermomechanics of slender rods by a direct approach based on the theory of a Cosserat curve comprising a one-dimensional curve and a pair of directors attached to every point of the curve. In all previous developments of the thermomechanical theory of rods by direct approach, only one temperature field has been admitted. This allows for the characterization of temperature changes along some reference curve, such as the line of centroids of the (three-dimensional) rod-like body, but not the temperature changes across the rod cross-section. A main purpose of the present study is to incorporate the latter effect into the theory; and, in the context of the theory of a Cosserat curve to thermomechanics which provides

a natural way to introducing more than one temperature field at each material point of the curve. Apart from full discussion of thermomechanics of rods and thermodynamical restrictions arising from the second law of thermodynamics for rods, attention is given to a discussion of symmetries (including material symmetries) of rods which in a reference configuration are straight. GRA

N79-25435# Army Armament Research and Development Command, Watervliet, N. Y. Weapons Lab.
SINGULAR PLASTIC ELEMENT: NASTRAN IMPLEMENTATION AND APPLICATION
M. A. Hussain, S. L. Pu, and W. E. Lorensen Dec. 1978 30 p refs
(DA Proj. 1L1-61102-AH-45)
(AD-A067196; AD-E440024) Avail: NTIS HC A03/MF A01 CSCL 20/11

The elastic and plastic singularities near a crack tip are obtained from higher order isoparametric elements. This is simply accomplished by collapsing the quadrilateral element into a triangular element and by judicious choice of adjacent mid-side nodes. Specifically for the cubic element, the elastic singularity is obtained by placing the mid-side nodes adjacent to the crack tip at 1/9th and 4/9th locations. The plastic singularity is constructed using the sliding node concept. These elements have been implemented in NASTRAN as user dummy elements. GRA

N79-25436# Failure Analysis Associates, Palo Alto, Calif.
BIGIF: FRACTURE MECHANICS CODE FOR STRUCTURES. MANUAL 1: INTRODUCTION AND THEORETICAL BACKGROUND
P. M. Besuner, D. C. Peters, and R. C. Cipolla Jul. 1978 43 p refs Sponsored by the Electric Power Research Inst., Palo Alto, Calif.
(EPRI-NP-838) Avail: NTIS HC A03/MF A01

Fracture mechanics life prediction requires calculation of crack tip stress intensity factors to quantify both stable crack growth and the conditions for unstable fracture in complex geometries under complex elastic loading conditions which lead to high stress gradients. The BIGIF computer code was developed to perform accurately and inexpensively these life predictions for a wide range of two- and three-dimensional stress fields and cracks and structural geometries, given that the elastic stress solution for the uncracked structure is available from another independent source. This general description manual is the first of three manuals documenting BIGIF. DOE

N79-25437# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft-und Raumfahrtkonstruktionen.
NUMERICAL SOLUTION OF INELASTIC RATE PROCESSES
K. J. Willam Nov. 1977 60 p refs
(ISD-229) Avail: NTIS HC A04/MF A01

The computational aspects of inelastic analysis with emphasis on the solution of first order rate processes were studied. The fundamental objective of the work was to develop incremental solution methods for nonlinear differential equation systems. Single viscoelastic rate processes (linear and nonlinear), general inelastic rate processes, and inelastic finite element analysis were investigated. Concrete creep was treated as a practical example of the application of this analysis and results are detailed. Author (ESA)

N79-25438# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
DETERMINATION OF FATIGUE PERFORMANCE DATA ON STRUCTURAL MATERIALS UNDER TYPIFIED RANDOM LOADING: AXIALLY LOADED NOTCHED SPECIMENS OF MILD STEEL RRSt 52-3 (SAE 1030)
E. Gassner and H.-G. Koebler Jun. 1978 104 p refs In GERMAN; ENGLISH summary
(LFB-TB-127) Avail: NTIS HC A06/MF A01

Fundamental aspects of the determination of fatigue performance data and test results of the mild steel St 52 - 3(SAE 1030) are presented and discussed. Fatigue performance data obtained from fatigue tests characterize the fatigue strength behavior of structural components or notched specimens respectively under typified random loading. In special cases fatigue performance data enabled fatigue life predictions of structural components to be made. The necessity of typifying the random load sequence is shown. Some technical details of the testing procedure are mentioned. Author (ESA)

N79-25439# Purdue Univ., Lafayette, Ind. School of Aeronautics and Astronautics.
DYNAMIC RESPONSE OF HIGH PRESSURE STEAM PIPE IN A FOSSIL FUEL POWER PLANT
C. T. Sun, H. Lo, J. L. Bogdanoff, and Y. F. Chou Apr. 1978 54 p refs
(Grant NSF ENV-74-01575; NSF GI-41897)
(PB-292553/5; NSF/RA-780530) Avail: NTIS HC A04/MF A01 CSCL 13K

The dynamic behavior of a high pressure steam pipe in the fossil fuel power plant at Paradise, Kentucky was investigated. This piping system connects the header at the top of the steam generator to the turbine at the ground level. The pipe was assumed fixed at the ground level and either fixed or attached to a shear beam model that represents the frame structure of the power plant. Free vibrations were studied first. Then, dynamic responses of the system subjected to the NS component of the ground acceleration in the El Centrol 1940 earthquake record were obtained. The effects of damping, the material stiffness and the frame structure on the piping responses were also investigated. GRA

N79-25440# Nuclear Regulatory Commission, Washington, D. C. Pipe Crack Study Group.
INVESTIGATION AND EVALUATION OF STRESS-CORROSION CRACKING IN PIPING OF LIGHT WATER REACTOR PLANTS
Feb. 1979 98 p refs
(PB-292044/5; NUREG-0531) Avail: NTIS HC A05/MF A01 CSCL 13K

The areas considered by the pipe crack study group and summarized in this report are: pressure water reactor and boiling water reactor cracking experience, metallurgy associated with pipe cracking, reactor coolant chemistry, pipe configuration and stress levels, Duane Arnold safe-end cracking, methods of detecting significance of cracks, and recent developments relevant to control and detection of intergranular stress corrosion cracking. GRA

N79-25441# Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
APPROXIMATE STOCHASTIC ANALYSIS OF COMBINED LOADING Research Report, Jun. 1974 - Aug. 1979
Richard D. Larrabee and C. Allin Cornell Sep. 1978 184 p refs
(Grant NSF ENV-73-03345)
(PB-292708/5; MIT-CE-R-78-28) Avail: NTIS HC A09/MF A01 CSCL 13M

A simple, unified formulation for the probabilistic combination of structural loads-the point crossing method-is based on finding the mean upcrossing rate of the sum of independent individual load processes. This formulation was compared to other probablistic load combination methods. Also, some issues of vector-valued load-effects, and safe domains, and selected types of dependence were investigated. GRA

42 GEOSCIENCES (GENERAL)

No abstracts in this category.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography.*

N79-25442 British Library Lending Div., Boston Spa (England).
DIGITAL PROCESSING OF THE NOAA WEATHER SATELLITE SCANNING-RADIOMETER (SR) DATA RECEIVED AT THE FU METEOROLOGICAL INSTITUTE. PART 4: GEOGRAPHICAL RECTIFICATION AND PRESENTATION IN A STEREOGRAPHIC MAP PROJECTION
D. Koslowsky 6 Nov. 1978 33 p refs Transl. into ENGLISH of West German report, Freie Univ., Inst. Met. u. Inst. Geoph. Wissensch., Met. Abh., Neue Folge, Ser. B. H. 9, 1977, Beil. 86/77 32 p
(BLL-Trans-1362-(9022.549)) Avail: British Library Lending Div., Boston Spa, Engl.

Each measurement of the system composed of the Earth's surface and the atmosphere taken by the radiometer on board a near polar orbiting satellite is a unique event. In order to extract as much information as possible from the measurements they must be rendered physically and geographically comparable; this means standardizing the data. Meteorological research is interested in the space and time variation over the course of hours and days, of the meteorologically significant structures they reveal, and this with the aim of connecting them with other meteorological parameters. An operational method was developed for this standardization, offering rectification of the satellite data into a polar stereographic projection, almost in real time. All programs are run on a DEC PDP 11/45 minicomputer. G.Y.

N79-25443* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
COAL-SHALE INTERFACE DETECTION Patent
Peter H. Broussard, John L. Burch, Edward J. Drost, and Richard J. Stein, inventors (to NASA) Issued 15 May 1979 8 p Filed 3 Nov. 1977
(NASA-Case-MFS-23720-3; US-Patent-4,154,084; US-Patent-Appl-SN-848420; US-Patent-Class-73-12; US-Patent-Class-73-82) Avail: US Patent and Trademark Office CSCL 08I

A penetrometer for coal-shale interface detection is presented. It is used with coal cutting equipment consisting of a reciprocating hammer, having an accelerometer mounted thereon to measure the impact of the hammer as it penetrates the ceiling or floor surface of a mine. Additionally, a pair of reflectometers simultaneously view the same surface, and the outputs from the accelerometer and reflectometers are detected and jointly registered to determine when an interface between coal and shale is being cut through.
Official Gazette of the U.S. Patent and Trademark Office

N79-25444* National Aeronautics and Space Administration, Washington, D. C.
EARTH RESOURCES: A CONTINUING BIBLIOGRAPHY WITH INDEXES, ISSUE 21
Apr. 1979 95 p
(NASA-SP-7041(21)) Avail: NTIS HC E05 CSCL 05B

A bibliography list of 369 reports, articles, and other documents introduced into the NASA scientific and technical information system between January 1, 1979 and March 31, 1979 is presented. Emphasis is placed on the use of remote sensing and geophysical instrumentation in spacecraft and aircraft to survey and inventory natural resources and urban areas. Subject matter is grouped according to agriculture and forestry, environmental changes and cultural resources, geodesy and cartography, geology and mineral resources, hydrology and water management, data processing and distribution systems, instrumentation and sensors, and economic analysis. G.Y.

N79-25445 Colorado School of Mines, Golden.
A STUDY OF THE PHYSICAL AND CHEMICAL PROPERTIES OF OIL SHALE RELEVANT TO PHYSICAL CONCENTRATION PROCESSES Ph.D. Thesis
Donald James Kaczynski 1977 220 p
Avail: Univ. Microfilms Order No. 7912216

The physical and surface chemical properties of an oil shale relevant to physical concentration processes were studied, with a view to applications of such processes. Complete liberation was not achieved, even for particles in the low micron size range, and the preferential breakage of the high-grade organic portion of the materials into coarse, flat particles in the treatment of more conventional ores. Treatment of a -3/8 inch feed in a heavy medium of s.g. 2.3 resulted in the recovery of 80 percent of the organics in 50 percent of the original weight. Treating a -10 mesh feed on a shaking table gave slightly inferior results. Separation in an upward flowing water current was not an effective concentration process, but indicated the superiority of classification over screening in any proposed closed grinding circuit.
Dissert. Abstr.

N79-25446*# Mississippi State Univ., Mississippi State.
APPLICATION OF REMOTE SENSING TO STATE AND REGIONAL PROBLEMS Semiannual Progress Report, 1 Nov. 1978 - 30 Apr. 1979
W. Frank Miller, Principal Investigator, Dale A. Quattrochi, Bradley D. Carter, Gary K. Higgs, Jimmy L. Solomon, and Charles L. Wax 1 May 1979 101 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Grant NGL-25-001-054)
(E79-10196; NASA-CR-158510; SAPR-11) Avail: NTIS HC A06/MF A01 CSCL 05A

The author has identified the following significant results. The Lowndes County data base is essentially complete with 18 primary variables and 16 proximity variables encoded into the geo-information system. The single purpose, decision tree classifier is now operational. Signatures for the thematic extraction of strip mines from LANDSAT Digital data were obtained by employing both supervised and nonsupervised procedures. Dry, blowing sand areas of beach were also identified from the LANDSAT data. The primary procedure was the analysis of analog data on the I2S signal slicer.

N79-25447*# Ecosystems International, Inc., Gambrills, Md.
GLOBAL CROP PRODUCTION FORECASTING DATA SYSTEM ANALYSIS Final Report
Peter A. Castruccio, Principal Investigator, Harry L. Loats, and Donald G. Lloyd Jan. 1978 192 p refs ERTS
(Contract NAS8-32408)
(E79-10198; NASA-CR-161199; ECO-1979-3) Avail: NTIS HC A09/MF A01 CSCL 02C

The author has identified the following significant results. Findings led to the development of a theory of radiometric discrimination employing the mathematical framework of the theory of discrimination between scintillating radar targets. The theory indicated that the functions which drive accuracy of discrimination are the contrast ratio between targets, and the number of samples, or pixels, observed. Theoretical results led to three primary consequences, as regards the data system: (1) agricultural targets must be imaged at correctly chosen times, when the relative evolution of the crop's development is such as to maximize their contrast; (2) under these favorable conditions, the number of observed pixels can be significantly reduced with respect to wall-to-wall measurements; and (3) remotely sensed radiometric data must be suitably mixed with other auxiliary data, derived from external sources.

N79-25448*# Minnesota Univ., Minneapolis. Space Science Center.
A STUDY OF MINNESOTA LAND AND WATER RESOURCES USING REMOTE SENSING Progress Report, 1 Jan. - 31 Dec. 1978
William Shepherd, Principal Investigator 1 Jan. 1979 167 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Grant NGL-24-005-263)
(E79-10199; NASA-CR-158511) Avail: NTIS HC A08/MF A01 CSCL 08H

There are no author-identified significant results in this report.

N79-25449*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
THE ANALYTICAL DESIGN OF SPECTRAL MEASUREMENTS FOR MULTISPECTRAL REMOTE SENSOR SYSTEMS
D. J. Wiersma and D. A. Landgrebe, Principal Investigators 1979 272 p refs EREP
(Contract NAS9-15466)
(E79-10200; NASA-CR-160170; LARS-TR-122678; TR-EE-79-13) Avail: NTIS HC A12/MF A01 CSCL 14B

The author has identified the following significant results. In order to choose a design which will be optimal for the largest class of remote sensing problems, a method was developed which attempted to represent the spectral response function from a scene as accurately as possible. The performance of the overall recognition system was studied relative to the accuracy of the spectral representation. The spectral representation was only one of a set of five interrelated parameter categories which also included the spatial representation parameter, the signal to noise ratio, ancillary data, and information classes. The spectral response functions observed from a stratum were modeled as a stochastic process with a Gaussian probability measure. The criterion for spectral representation was defined by the minimum expected mean-square error.

N79-25450*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). AN EARLY ESTIMATE OF SMALL GRAINS ACREAGE
Robert N. Lea and Dennis M. Kern, Principal Investigators (NRC) Mar. 1979 48 p refs Sponsored by NASA, NOAA, and USDA EREP
(E79-10201; NASA-TM-80418; Rept-79-FM-13; JSC-14782) Avail: NTIS HC A03/MF A01 CSCL 02C

The author has identified the following significant results. A major advantage of this scheme is that it needs minimal human intervention. The entire scheme, with the exception of the choice of dates, can be computerized and the results obtained in minutes. The decision to limit the number of acquisitions processed to four was made to facilitate operation on the particular computer being used. Some earlier runs on another computer system were based on as many as seven biophase-1 acquisitions.

N79-25451*# Michigan State Univ., East Lansing.
USE OF REMOTE SENSING FOR LAND USE POLICY FORMULATION Annual Progress Report, Dec. 1977 - Nov. 1978
Myles Boylan, Principal Investigator 9 Mar. 1979 74 p refs ERTS
(Grant NGL-23-004-083)
(E79-10202; NASA-CR-158557) Avail: NTIS HC A04/MF A01 CSCL 05A

There are no author-identified significant results in this report.

N79-25452*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
THE APPLICATION OF REMOTE SENSING TECHNOLOGY TO THE SOLUTION OF PROBLEMS IN THE MANAGEMENT OF RESOURCES IN INDIANA Semiannual Report, 1 Jun. - 30 Nov. 1978
R. A. Weismiller and R. P. Mroczynski, Principal Investigators 30 Nov. 1978 75 p refs ERTS
(Grant NGL-15-005-186)
(E79-10203; NASA-CR-158558; LARS-CR-042179) Avail: NTIS HC A04/MF A01 CSCL 05A

The author has identified the following significant results. Of the sampling techniques considered, a combination soil mapping and area sampling offered the most practical method for gathering soils data. Using the dot grid count, a relative percentage composition of soils can be calculated for each spectral class. From these percentages, a legend describing the dominant soils and inclusions can be developed. Interval drainage class seemed to be correlated with magnitude. For every parent material area, the more poorly drained soils had a lower magnitude of reflectance. Soil spectral classes seemed to be predominantly one internal drainage class.

N79-25453*# Wisconsin Univ., Madison. Inst. for Environmental Studies.
MULTIDISCIPLINARY RESEARCH ON THE APPLICATION OF REMOTE SENSING TO WATER RESOURCES PROBLEMS Progress Report, Aug. 1977 - Jul. 1978
Ralph W. Kiefer, Principal Investigator Jul. 1978 100 p refs Original contains color imagery. Original Photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Grant NGL-50-002-127)
(E79-10204; NASA-CR-158559) Avail: NTIS HC A05/MF A01 CSCL 08H

There are no author-identified significant results in this report.

N79-25454*# Delaware Univ., Newark. Coll. of Marine Studies.
QUANTITATIVE ASSESSMENT OF EMERGENT BIOMASS AND SPECIES COMPOSITION IN TIDAL WETLANDS USING REMOTE SENSING
David S. Barlett and Vytautas Klemas, Principal Investigators 1979 16 p refs Presented at Workshop on Wetland and Estuarine Processes and Water Quality Modeling, New Orleans, La., 10-18 Jun. 1979 Sponsored by NASA ERTS
(E79-10205; NASA-CR-158560) Avail: NTIS HC A02/MF A01 CSCL 08C

There are no author-identified significant results in this report.

N79-25455*# Delaware Univ., Newark. Coll. of Marine Studies.
ASSESSMENT OF TIDAL WETLAND HABITAT AND PRODUCTIVITY
David S. Barlett and Vytautas Klemas, Principal Investigators 1979 11 p refs Presented at 13th Intern. Symp. on Remote Sensing of Environment, Ann Arbor, Mich., 23-27 Apr. 1979 ERTS
(E79-10206; NASA-CR-158561) Avail: NTIS HC A02/MF A01 CSCL 08C

There are no author-identified significant results in this report.

N79-25456*# Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
INFERENCE OF EFFECTIVE SOIL PROPERTIES FROM OBSERVED VEGETAL CANOPY DENSITY Progress Report
Peter S. Eagleson, Principal Investigator [1979] 8 p refs ERTS
(Grant NsG-5306)
(E79-10207; NASA-CR-158562) Avail: NTIS HC A02/MF A01 CSCL 08M

There are no author-identified significant results in this report.

N79-25457*# National Aeronautics and Space Administration. Earth Resources Lab., Slidell, La.
NATURAL RESOURCES INVENTORY SYSTEM ASVT PROJECT Final Report
Armond T. Joyce, Principal Investigator Apr. 1978 129 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D., 57198 ERTS
(E79-10208; NASA-TM-80416; Rept-174) Avail: NTIS HC A07/MF A01 CSCL 05B

The author has identified the following significant results. One of the main advantages, both cost-wise and time-wise, of the natural resource inventory system involved the use of LANDSAT-acquired digital data for the land cover information component; thereby, eliminating the need to digitize such dynamic information from a map or aerial photo base. It was thought that the utility and the cost of information as derived from LANDSAT data for the various applications justified the operational use of data generated by LANDSAT.

N79-25458*# National Aeronautics and Space Administration. Earth Resources Lab., Slidell, La.
A DEMONSTRATION OF WETLAND VEGETATION MAPPING IN FLORIDA FROM COMPUTER-PROCESSED

SATELLITE AND AIRCRAFT MULTISPECTRAL SCANNER DATA
M. Kristine Butera, Principal Investigator May 1978 57 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E79-10209; NASA-TM-80415; Rept-168) Avail: NTIS HC A04/MF A01 CSCL 08B

The author has identified the following significant results. Major vegetative classes identified by the remote sensing technique were cypress swamp, pine, wetland grasses, salt grass, mixed mangrove, black mangrove, and Brazilian pepper. Australian pine and melaleuca were not satisfactorily classified from LANDSAT. Aircraft scanners provided better resolution resulting in a classification of finer surface detail. An edge effect, created by the integration of diverse spectral responses within boundary elements of digital data, affected the wetlands classification. Accuracy classification for aircraft was 68% and for LANDSAT was 74%.

N79-25459*# National Aeronautics and Space Administration. Earth Resources Lab., Slidell, La.
A PROCEDURE FOR EXTRACTION OF DISPARATE DATA FROM MAPS INTO COMPUTERIZED DATA BASES
Bobby G. Junkin, Principal Investigator Apr. 1978 53 p refs Original contains color illustrations ERTS
(E79-10210; NASA-TM-80414; Rept-167) Avail: NTIS HC A04/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N79-25460*# National Aeronautics and Space Administration, Washington, D. C.
MATHEMATIC MODELING OF THE EARTH'S SURFACE AND THE PROCESS OF REMOTE SENSING
B. M. Balter Jun. 1979 32 p refs Transl. into ENGLISH of "Matematicheskoye Modelirovaniye Zemnoy Poverkhnosti i Protsessa Distantsionnogo Zondirovaniya", Rept. Pr-354 Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1977 p 1-29 Transl. by Sci. Transl. Serv., Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75622; Pr-354) Avail: NTIS HC A03/MF A01 CSCL 08B

It is shown that real data from remote sensing of the Earth from outer space are not best suited to the search for optimal procedures with which to process such data. To work out the procedures, it was proposed that data synthesized with the help of mathematical modeling be used. A criterion for simularity to reality was formulated. The basic principles for constructing methods for modeling the data from remote sensing are recommended. A concrete method is formulated for modeling a complete cycle of radiation transformations in remote sensing. A computer program is described which realizes the proposed method. Some results from calculations are presented which show that the method satisfies the requirements imposed on it. G.Y.

N79-25461*# General Electric Co., Huntsville, Ala. Space Div.
SWATH WIDTH STUDY. A SIMULATION ASSESSMENT OF COSTS AND BENEFITS OF A SENSOR SYSTEM FOR AGRICULTURAL APPLICATION Final Report
Apr. 1979 59 p refs
(Contract NAS8-32491)
(NASA-CR-161232; Rept-79HV001) Avail: NTIS HC A04/MF A01 CSCL 02C

Satellites provide an excellent platform from which to observe crops on the scale and frequency required to provide accurate crop production estimates on a worldwide basis. Multispectral imaging sensors aboard these platforms are capable of providing data from which to derive acreage and production estimates. The issue of sensor swath width was examined. The quantitative trade trade necessary to resolve the combined issue of sensor swath width, number of platforms, and their orbits was generated and are included. Problems with different swath width sensors were analyzed and an assessment of system trade-offs of swath width versus number of satellites was made for achieving Global Crop Production Forecasting. Author

N79-25462# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
ORBITAL PHOTOGRAMMETRIC TRIANGULATION WITH DYNAMICAL CONSTRAINTS Final Report
John L. Junkins, Mahesh Rajan, and James D. Turner Mar. 1979 53 p refs
(Grants DAAG29-77-G-0018)
(AD-A067272; ARO-13794.2-GS; ARO-15551.1-GS) Avail: NTIS HC A04/MF A01 CSCL 08/2

The concept, implementation, and results of incorporating spacecraft motion constraints into the process of triangulating orbitial photography is investigated. Feasibility and desirability of several approaches to this problem are established relative to conventional unconstrained triangulation. Author (GRA)

N79-25463# RCA Advanced Technology Labs., Camden, N. J.
SCANNING CURSOR TECHNIQUES 2 Final Technical Report, Oct. 1977 - Jun. 1978
G. W. Hunka Griffiss AFB, N. Y. RADC Feb. 1979 34 p
(Contract F30602-77-C-0243; AF Proj. 5569)
(AD-A067318; RADC-TR-79-2) Avail: NTIS HC A03/MF A01 CSCL 08/2

The objective of the program was to convert a successfully demonstrated transmissive scanning cursor to operate in a reflective mode, for use on opaque cartographic manuscripts. The transmissive cursor, employing a linear photosensitive array for feature sensing, was designed for aided-track tracing of backlighted material, and provides automatic corrections for tracing errors when digitizing cartographic materials. GRA

N79-25464# Stanford Univ., Calif. Systems Optimization Lab.
A LAND MANAGEMENT MODEL USING DANTZIG-WOLFE DECOMPOSITION
L. Nazareth Dec. 1978 38 p refs
(Contracts N00014-75-C-0267; EY-76-S-03-0326; Grants NSF MCS-76-20019; NSF ENG-77-06761)
(AD-A066444; SU-SOL-78-31) Avail: NTIS HC A03/MF A01 CSCL 12/2

This paper deals with a mathematical model designed to provide guidelines for managing a land resource over an extended period of time. We develop a framework which permits sequences of management decisions to be conveniently formulated, and their associated costs and benefits specified. This takes the form of a network. Each path in the network represents a possible decision sequence. We study how to select suitable decision sequences and what proportion of the resource to manage with each selected sequence, so as to optimize some specified objective and meet the constraints imposed on management of the resource. An L.P. model is formulated. The solution strategy decomposes the L.P. matrix using Dantzig-Wolfe decomposition and solves the subproblems efficiently by dynamic programming or a network flow algorithm. Computational aspects are discussed and the concepts and procedures are illustrated in the Appendix, for forest management. Author (GRA)

N79-25465# Texas A&M Univ., College Station. Coll. of Geosciences.
SONAR PROBING AS A MINING AND TUNNELING TOOL Progress Report, 1 Jun. - 20 Dec. 1978
Robert R. Unterberger Dec. 1978 99 p refs
(Grant NSF APR-76-21764)
(PB-292243/3; NSF/RA-780520) Avail: NTIS HC A05/MF A01 CSCL 08I

Acoustic probing is used as a tool to investigate discontinuities in salt. A narrow beam of sound is needed to accomplish this. Although the original approach to obtaining a narrower beam in salt was the standard one of using a large transducer, it was found more effective to use nonlinear acoustics to generate the narrow beam of 24 KHz within the salt itself and use the Sonar II system as a receiver. Some results of investigations into nonlinear acoustics are recounted. A mathematical analysis of acoustic scattering from various cylinders is presented. The latest research results in the Grand Saline salt mine are reported. GRA

N79-25466# Austrian Solar and Space Agency, Vienna.
REMOTE SENSING IN AUSTRIA. SURVEY OF EXISTING

AND PLANNED PROJECTS [FERNERKUNDUNG IN OESTERREICH. UEBERSICHT BESTEHENDER UND GEPLANTER VORHABEN]
Graz Oct. 1977 119 p In GERMAN Sponsored by Bundesmin. fuer Wiss. u. Forsch. Original contains color illustrations
(ASSA-FA-7) Avail: NTIS HC A06/MF A01

Austrian remote sensing applications include basic research and system development, agriculture, forestry, water management, regional planning, environment protection, and geology. The existing and future programs of aeromagnetic measurements are given, as well as the sources of aerial and satellite data procurement. J.A.M.

N79-25467# Purdue Univ., Lafayette, Ind. School of Civil Engineering.
GREEN RIVER DATA BASE SYSTEM
S. Stevens, A. R. Rao, G. H. Toebes, and A. Chossiakos Oct. 1978 164 p Sponsored by the Interior Dept.
(PB-290845/7; CE-HSE-78-2; W79-04009) Avail: NTIS HC A08/MF A01 CSCL 13B

A formal data bases management system was developed for use in reservoir operations model development. Time series of reservoir elevations and discharges of temperature and precipitation, and of stream stages and discharges for the Green River Basin, Ky. were collected and stored. Efficient programs for data addition, data editing, data retrieval, and data base commenting were developed. A User's Manual and a Programmer's Manual are included. In addition to its utility in model construction, the data base may be useful when satellite and/or radar data increase the input data management problem in real-time reservoir system operation using a comprehensive simulation model. GRA

N79-25468# Geological Survey, Baton Rouge, La. Water Resources Div.
WATER RESOURCES DATA FOR LOUISIANA, WATER YEAR 1978. VOLUME 1: CENTRAL AND NORTHERN LOUISIANA Annual Water-Data Report, 1 Oct. 1977 - 30 Sep. 1978
Dec. 1978 423 p Sponsored in part by Fish and Wildlife Service, Corps of Engineers Prepared in cooperation with Louisiana Dept. of Transportation and Development, Baton Rouge
(PB-292412/4; USGS/WRD/HD-78/079-Vol-1) Avail: NTIS HC A18/MF A01 CSCL 13B

Water resources data for the 1978 water year for Louisiana consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground water. The following discharge records for 76 gaging stations; stage records for 66 of these gaging stations; stage only for 32 gaging stations; contents for 1 reservoir stage only for 12 lakes; water quality for 147 stations; 22 of these at gaging stations; 80 miscellaneous sites, 10 lakes, and 169 wells; and water levels for 696 observation wells. Also included are 199 crest-stage partial-record stations and flood-profile partial-record stations. Records for a few pertinent stations in bordering the States are also included. GRA

N79-25469# General Electric Co., Schenectady, N. Y.
HIGH-GRADIENT MAGNETIC SEPARATION FOR REMOVAL OF SULFUR FROM COAL Final Report, 1 Mar. 1976 - 31 Jan. 1977
F. E. Luborsky Nov. 1978 90 p refs Sponsored in part by EPA and DOE
(Contract DI-BM-HO-366008)
(PB-290945/5; EPA-600/7-78-208; FE-8969-1) Avail: NTIS HC A05/MF A01 CSCL 08I

Results of a thorough physical, chemical, and magnetic characterization of a Pennsylvania coal from the Upper Freeport seam are given. The powdered coal was then subjected to high-gradient magnetic separations, as a function of slurry and an air dispersion. Ash and pyritic sulfur reductions occurred with increasing magnetic field intensities and decreasing fluid velocities. The best results were obtained in water slurries where approximately 50 percent of the total sulfur and 50 percent of the ash were removed. Air dispersions produced insignificant results. GRA

N79-25470# Geological Survey, Menlo Park, Calif. Water Resources Div.
WATER RESOURCE DATA FOR CALIFORNIA, WATER YEAR 1977. VOLUME 4: NORTHERN CENTRAL VALLEY BASINS AND THE GREAT BASIN FROM HONEY LAKE BASIN TO OREGON STATE LINE Annual Report, 1 Oct. 1976 - 30 Sep. 1977
Oct. 1978 437 p refs Prepared in cooperation with Calif. State Dept. of Water Resources, Sacramento
(PB-292257/3; USGS/WRD/HD-78/077; USGS/WRD/CA-77/4) Avail: NTIS HC A19/MF A01 CSCL 08H

Records of stage, discharge, and water quality of streams, lakes and reservoirs are given along with water levels in wells. Also included are crest-stage partial-record stations, low-flow partial-record stations, and water-quality partial-record stations. GRA

N79-25471# Oklahoma Univ., Norman. Bureau of Water and Environmental Resources Research.
AN ANALYTICAL MODEL FOR ESTABLISHING WATER RESOURCES DEVELOPMENT PRIORITIES Final Report
George W. Reid and Tom W. K. Leung 28 Jun. 1979 134 p refs Sponsored by the Dept. of Interior
(PB-292562/6; W79-04586; OWRT-A-072-OKLA(1)) Avail: NTIS HC A07/MF A01 CSCL 13B

A priority analysis procedure for ranking water resources development projects is described. The procedure is based on a scoring model approach that evaluates water resources development projects in terms as many as eighteen parameters. It recognizes needs and deficiencies and also incorporates the following features: socio-economic impacts, environmental effects, continuity, and local political reactions. The Delphi technique is used to determine the weights of the individual parameters. The water resources development projects are categorized according to three functional groups, i.e., water treatment facilities, impoundment systems, and groundwater. The projects are ranked within each category. GRA

N79-25472# Bituminous Coal Research, Inc., Monroeville, Pa.
COAL AND THE ENVIRONMENT ABSTRACT SERIES. BIBLIOGRAPHY ON DISPOSAL OF REFUSE FROM COAL MINES AND COAL CLEANING PLANTS
V. E. Gleason, comp. and Ronald D. Hill, comp. May 1978 189 p refs Prepared in cooperation with Industrial Environmental Research Lab., Cincinnati, Oh.
(Grant EPA-R-805336)
(PB-292099/9; EPA-600/7-79-076) Avail: NTIS HC A09/MF A01 CSCL 08I

The subjects covered in this bibliography include the analysis and characterization of coal refuse; various methods of handling, storing, and disposing of coal refuse; the environmental problems such as refuse drainage quality and combustion of refuse piles; the control of environmental problems; and the uses for refuse which were investigated. The coal cleaning process itself is very closely related to the general subject area covered in this bibliography. However, the large number of publications available on coal cleaning are not included unless they contained information that contributed significantly to the knowledge and understanding of coal refuse and its related disposal problems. In addition to the abstracts, this volume includes an Author Index and a General Index. GRA

N79-25473# Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
HYDROLOGIC PARAMETERS FROM LANDSAT IMAGERY FOR WILLIAMS FORK WATERSHED M.S. Thesis
Jose Elvecio Pernia 1978 138 p refs Sponsored by Interior Dept.
(PB-292083/3; W79-04073; OWRT-B-160-COLO(1)) Avail: NTIS HC A07/MF A01 CSCL 08H

Mapping the major cover types of the Williams Fork Watershed, extracting physiographic parameters of the basin, and temporal mapping of snowcover were the main objectives of the study. Physiographic parameters for the studied watershed, including watershed area, perimeter, basin shape, basin axial length, length of main stream, total stream length, drainage density, and drainage pattern, were derived from the LANDSAT

MSS transparencies using visual interpretation. Temporal snowcover mapping the Williams Fork Watershed was performed, using a zoom transfer scope, on the LANDSAT transparencies, for USS band 5. GRA

N79-25474# Florida Univ., Gainesville. Water Resources Research Center.
MEASUREMENT OF EVAPORATION FROM LAKES AND PONDS IN FLORIDA
J. F. Bartholic, R. G. Bill, Jr., and L. H. Allen, Jr. Sep. 1978 86 p refs
(Contracts DI-14-34-0001-8010; DI-14-31-0001-6010)
(PB-292561/8; WRRC-PUB-43; W79-04583;
OWRT-A-031-FLA(2)) Avail: NTIS HC A05/MF A01 CSCL 08H

Instrumentation to measure the Bowen ratio was adapted to measure latent and sensible heat fluxes from Lake Apopka. In addition to the measurement of energy fluxes from Lake Apopka, thermal imagery indicated the downwind distance for which thermal effects due to the lake were significant. Direct measurements of evaporation on Orange Lake were reported. The eddy correlation technique was employed using an ultra-sonic anemometer thermometer and a Lyman-alpha humidity to predict the diurnal variation in the flux of latent heat from East Lake Tohopekeliga. GRA

N79-25475# Massachusetts Inst. of Tech., Cambridge. Francis Bitter National Magnetic Lab.
MAGNETITE RECOVERY IN COAL WASHING BY HIGH GRADIENT MAGNETIC SEPARATION Final Report, Mar. 1976 - Dec. 1977
E. Maxwell and D. R. Kelland Sep. 1978 71 p refs
(Contract ET-76-C-01-8887)
(PB-290915/8; EPA-600/7-78-183; FE-8887) Avail: NTIS HC A04/MF A01 CSCL 08I

A demonstration of the successful recovery of magnetite from mixtures of magnetite and coal, like those found in a coal-washing circuit, by High Gradient Magnetic Separation is described. High values of magnetite recovery were achieved at resonably high material throughput rates with little coal found reporting to the magnetics. A single-stage separator incorporating a new matrix design was used at rates up to 4.4 tons of solids per hour per square foot of matrix cross section (300 gpm/sq ft). At this throughput rate, more than 99% of the magnetite was trapped along with less than 5% of the coal. Magnetic field values no higher than 6 kilogauss were used to achieve these results, a value well within the range of present commercial magnet designs. GRA

N79-25476# Geological Survey, Lakewood, Colo. Water Resources Div.
WATER RESOURCES DATA FOR COLORADO, WATER YEAR 1977. VOLUME 1: MISSOURI RIVER BASIN, ARKANSAS RIVER BASIN, RIO GRANDE BASIN Annual Water-Data Report, 1 Oct. 1976 - 30 Sep. 1977
Nov. 1978 378 p refs
(PB-292258/1; USGS/WRD/HD-78/066;
USGS/WDR/CO-77/1) Avail: NTIS HC A17/MF A01 CSCL 08H

Water-resources data for Colorado for the 1977 water year consists of records of stage discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs, and water levels and water quality of wells and springs. This report (Volumes 1, 2, and 3) contains discharge records for 424 gaging stations, stage and contents of 25 lakes and reservoirs, 5 partial-record flow stations, 79 crest-stage partial-record stations, and 193 miscellaneous sites; water quality for 134 gaging stations and 60 miscellaneous sites; and water levels for 55 observation wells. A few pertinent stations in bordering States are also included. GRA

N79-25477# Geological Survey, Lakewood, Colo. Water Resources Div.
WATER RESOURCES DATA FOR COLORADO, WATER YEAR 1977. VOLUME 2: COLORADO RIVER BASIN ABOVE DOLORES RIVER Annual Water-Data Report, 1 Oct. 1976 - 30 Sep. 1977
Dec. 1978 379 p refs
(PB-292259/9; USGS/WRD/HD-78/078;
USGS/WDR/CO-77/2) Avail: NTIS HC A17/MF A01 CSCL 08H

Records of stage, discharge, contents, and water quality of streams, lakes, and reservoirs, are presented along with water levels and water quality of wells and springs. GRA

N79-25478# National Oceanic and Atmospheric Administration, Boulder, Colo. Marine Ecosystems Analysis Programs Office.
DEEP OCEAN MINING OF MANGANESE NODULES IN THE NORTH PACIFIC: PRE-MINING ENVIRONMENTAL CONDITIONS AND ANTICIPATED MINING EFFECTS
E. Ozturgut, G. C. Anderson, R. E. Burns, J. W. Lavelle, and S. A. Swift Dec. 1978 140 p refs
(PB-293545/0; NOAA-TM-ERL-MESA-33; NOAA-79020502)
Avail: NTIS HC A07/MF A01 CSCL 08I

Commercial-scale mining of manganese nodules in the tropical North Pacific is scheduled to begin in the 1980's. The pre-mining environmental conditions in the commercial nodule mining area are summarized, and those effects which are potentially directly discernible are identified and estimated. Field studies involved measurements of currents, light penetration, suspended particulate matter, pigments, primary productivity biochemical parameters, and zooplankton and micronekton in the upper layer. Temperature, salinity, nutrients, and dissolved oxygen content were measured throughout the water column. The studies in the lower column included currents, suspended particulate matter, and macro-zooplankton measurements. On the sea floor, the benthic population and characteristics of the sediments and pre-water were determined. GRA

N79-25981# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
THE REAL-TIME TACTICAL RECONNAISSANCE DATA HANDLING PROBLEM
Henry Lapp *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 6 p refs (For primary document see N79-25977 16-99)
Avail: NTIS HC A16/MF A01

N79-25984# Fraunhofer-Gesellschaft, Karlsruhe (West Germany).
INTEGRATING SENSORY INFORMATION IN A MULTISENSOR SYSTEM FOR BATTLEFIELD SURVEILLANCE
D. Paul and T. Partman *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 7 p ref (For primary document see N79-25977 16-99)
Avail: NTIS HC A16/MF A01

N79-25985# Northrop Corp., Hawthorne, Calif. Electronics Div.
TACTICAL RECONNAISSANCE WITH IMAGE EXPLOITATION
Gary L. Wycoff *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 7 p refs (For primary document see N79-25977 16-99)
Avail: NTIS HC A16/MF A01

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N79-25479* New Mexico Univ., Albuquerque. Technology Application Center.
SOLAR THERMAL COMPONENTS: A BIBLIOGRAPHY WITH ABSTRACTS Quarterly Update, Oct. - Dec. 1978
Apr. 1979 78 p Sponsored by NASA
(NASA-CR-158699) Avail: NTIS HC A05 for foreign requestors

only. Domestic orders, Univ. of New Mexico, Tech. Application Center, Albuquerque CSCL 10A

The final issue of the 1978 bibliographic series is presented. The update to Solar Thermal Components cites additional references identified during the fourth quarter (October-December) of 1978. G.Y.

N79-25480* New Mexico Univ., Albuquerque. Technology Application Center.

SOLAR THERMAL HEATING AND COOLING: A BIBLIOGRAPHY WITH ABSTRACTS Quarterly Update, Oct. - Dec. 1978

Apr. 1979 90 p refs Sponsored by NASA

(NASA-CR-158693) Avail: NTIS HC A05 for foreign requestors only. Domestic orders, Univ. of New Mexico, Tech. Application Center, Albuquerque CSCL 10A

The fourth and last issue of in the 1978 bibliographic series is presented. The volume, as well as the two companion volumes, presents the latest published research in the field of solar energy. G.Y.

N79-25481* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

IN SITU SELF CROSS-LINKING OF POLYVINYL ALCOHOL BATTERY SEPARATORS Patent

Warren H. Philipp, Li-Chen Hsu, and Dean W. Sheibley, inventors (to NASA) Issued 15 May 1979 5 p Filed 19 Apr. 1978 Supersedes N78-22157 (16 - 13, p 1674)

(NASA-Case-LEW-12972-1; US-Patent-4,154,912; US-Patent-Appl-SN-897829; US-Patent-Class-526-7; US-Patent-Class-429-253; US-Patent-Class-526-9) Avail: US Patent and Trademark Office CSCL 10C

A battery separator was produced from a polyvinyl alcohol sheet structure which was subjected to an in situ, self crosslinking process by selective oxidation of the 1,2 diol units present in the polyvinyl alcohol sheet structure. The 1,2 diol units were cleaved to form aldehyde end groups which subsequently crosslink through acetalization of the 1,3 diol units of the polyvinyl alcohol. Selective oxidation was achieved using a solution of a suitable oxidizing agent such as periodic acid or lead tetraacetate.

Official Gazette of the U.S. Patent and Trademark Office

N79-25482* National Aeronautics and Space Administration. Pasadena Office, Calif.

DOUBLE-SIDED SOLAR CELL PACKAGE Patent

Benjamin Shelpuk, inventor (to NASA) (JPL) Issued 8 May 1979 8 p Filed 29 Mar. 1978 Supersedes N78-22470 (16 - 13, p 1719) Sponsored by NASA

(NASA-Case-NPO-14199-1; NASA-Case-NPO-14200-1; US-Patent-4,153,476; US-Patent-Appl-SN-891243; US-Patent-Class-136-89PC; US-Patent-Class-136-89SJ; US-Patent-Class-136-89CC; US-Patent-Class-136-89CA) Avail: US Patent and Trademark Office CSCL 10A

In a solar cell array of terrestrial use, an improved double-sided solar cell package, consisting of a photovoltaic cell having a metallized P-contact strip and an N-contact grid, provided on opposite faces of the cell, a transparent tubular body forming an enclosure for the cell. A pedestal supporting the cell from within the enclosure comprising an electrical conductor connected with the P-contact strip provided for each face of the cell, and a reflector having an elongated reflective surface disposed in substantially opposed relation with one face of the cell for redirecting light were also included.

Official Gazette of the U.S. Patent and Trademark Office

N79-25483*# Materials Research, Inc., Centerville, Utah.

QUANTITATIVE ANALYSIS OF DEFECTS IN SILICON: SILICON SHEET GROWTH DEVELOPMENT FOR THE LARGE AREA SILICON SHEET TASK OF THE LOW COST SOLAR ARRAY PROJECT Quarterly Progress Report, 1 Oct. - 31 Dec. 1978

R. Natesh, J. M. Smith, and H. A. Qidwai 31 Dec. 1978 140 p refs Sponsored by NASA Prepared for DOE and JPL (Contract JPL-954977)

(NASA-CR-158709; MRI-264; DOE/JPL-954977-78/1; QPR-3) Avail: NTIS HC A07/MF A01 CSCL 10A

The various steps involved in the chemical polishing and etching of silicon samples are described and the data on twins, grain boundaries and dislocation pits from fifty-three (53) samples are discussed. G.Y.

N79-25484*# Spire Corp., Bedford, Mass.

DEVELOPMENT OF PULSED PROCESSES FOR THE MANUFACTURE OF SOLAR CELLS Interim Report

John A. Minnucci Dec. 1978 215 p refs Prepared for JPL and DOE

(Contract JPL-954786)

(NASA-CR-158706; IR-1; DOE/JPL-954786-78/06A; IR-77-10052-1) Avail: NTIS HC A10/MF A01 CSCL 10A

The results of a 1-year program to develop the processes required for low-energy ion implantation for the automated production of silicon solar cells are described. The program included: (1) demonstrating state-of-the-art ion implantation equipment and designing an automated ion implanter, (2) making efforts to improve the performance of ion-implanted solar cells to 16.5 percent AM1, (3) developing a model of the pulse annealing process used in solar cell production, and (4) preparing an economic analysis of the process costs of ion implantation. G.Y.

N79-25485*# OAO Corp., Beltsville, Md.

PROCEEDINGS OF THE US DOE PHOTOVOLTAICS TECHNOLOGY DEVELOPMENT AND APPLICATIONS PROGRAM REVIEW

1978 334 p refs Conf. held in Arlington, Va., 7-9 Nov. 1978 Prepared for DOE

(Contracts NAS7-100; JPL-BB-689-604)

(NASA-CR-158682; Conf-781191) Avail: NTIS HC A15/MF A01 CSCL 10A

Research in Photovoltaics and its applications is reported. For individual titles, see N79-25486 through N79-25497.

N79-25486*# Aerospace Corp., El Segundo, Calif.

PHOTOVOLTAIC MISSION ANALYSIS

S. L. Leonard *In* OAO Corp. Proc. of the US DOE Photovoltaics Technol. Develop. and Appl. Program Rev. 1978 p 1-1 - 1-15 (For primary document see N79-25485 16-44)

Avail: NTIS HC A15/MF A01 CSCL 10A

Photovoltaic analysis was used to support the planning, development, and guidance of the National Photovoltaic program. The analysis identified and evaluated: (1) photovoltaic applications likely to have major energy impact; (2) appropriate strategies for stimulating the growth of photovoltaic markets; and (3) critical issues, define scope of subsequent examinations. S.E.S.

N79-25487*# Massachusetts Inst. of Tech., Cambridge. Energy Lab.

PLANNING AND ANALYSIS FOR DEVELOPMENT OF PHOTOVOLTAIC ENERGY CONVERSION SYSTEMS

Richard D. Tabors *In* OAO Corp. Proc. of the US DOE Photovoltaics Technol. Develop. and Appl. Program Rev. 1978 p 1-16 - 1-22 (For primary document see N79-25485 16-44)

Avail: NTIS HC A15/MF A01 CSCL 10A

The project areas discussed include: (1) demand and decision analysis; (2) market analysis; (3) institutional analysis; (4) social cost analysis; and (5) performance and standard analysis. S.E.S.

N79-25488*# Sandia Labs., Albuquerque, N. Mex.

A SUMMARY OF SYSTEMS DEFINITION PROJECT ACTIVITIES Photovoltaic Systems Definition Project

Gary J. Jones and Kent L. Biringer *In* OAO Corp. Proc. of the US DOE Photovoltaics Technol. Develop. and Appl. Program Rev. 1978 p 1-23 - 1-91 (For primary document see N79-25485 16-44)

Avail: NTIS HC A15/MF A01 CSCL 10A

Design information and subsystem requirement definition to the overall program is presented. Application analysis and conceptual design for the wide variety of systems, system tradeoff studies and engineering design for the more promising application types, and the identification of the technology status and requirements for major subsystems and components are described. The residential design and analysis contracts, hybrid photovoltaic/solar thermal electric conversion contract, and development of prototype combined photovoltaic/thermal flat-plate collectors were studied. S.E.S.

N79-25489*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LOW-COST SOLAR ARRAY PROJECT
W. T. Callaghan *In* OAO Corp. Proc. of the US DOE Photovoltaics Technol. Develop. and Appl. Program Rev. 1978 p 1-93 - 1-121 (For primary document see N79-25485 16-44)
Avail: NTIS HC A15/MF A01 CSCL 10A

Technology development and technical feasibility are reviewed. Process and materials candidates to meet project goals were investigated. Integration of technical development with cost estimates is discussed. S.E.S.

N79-25490*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LSA ENGINEERING STATUS Low-cost Solar Array Project
R. Ross *In* OAO Corp. Proc. of the US DOE Photovoltaics Technol. Develop. and Appl. Program Rev. 1978 p 1-122 - 1-131 (For primary document see N79-25485 16-44)
Avail: NTIS HC A15/MF A01 CSCL 10A

Module engineering activities, environmental testing in research and development, and module requirement generation are discussed in the solar array project. S.E.S.

N79-25491*# Sandia Labs., Albuquerque, N. Mex.
STATUS OF THE DOE PHOTOVOLTAIC CONCENTRATOR DEVELOPMENT PROJECT Low-cost Solar Array Project
D. G. Schueler *In* OAO Corp. Proc. of the US DOE Photovoltaics Technol. Develop. and Appl. Program Rev. 1978 p 1-139 - 1-165 Sponsored by DOE (For primary document see N79-25485 16-44)
Avail: NTIS HC A15/MF A01 CSCL 10A

Photovoltaic concentrator technology resulting in low cost, long-life photovoltaic arrays at a price of less than $0.50 per peak watt by 1986 was developed. Concentrator concepts are identified which have the highest potential for low-cost long life by supporting concept development and evaluation, improving solar array manufacturing technology and by increasing solar array production capacity and quantity. S.E.S.

N79-25492*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DOE PHOTOVOLTAIC TESTS AND APPLICATIONS PROJECT
Ron Cull and Tony Ratajczak *In* OAO Corp. Proc. of the US DOE Photovoltaics Technol. Develop. and Appl. Program Rev. 1978 p 1-166 - 1-179 (For primary document see N79-25485 16-44)
Avail: NTIS HC A15/MF A01 CSCL 10A

The installation date, system and location, and solar arrays are tabulated. S.E.S.

N79-25493*# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SOLAR PHOTOVOLTAIC FIELD TESTS AND APPLICATIONS PROJECT
Ron Matlin *In* OAO Corp. Proc. of the US DOE Photovoltaics Technol. Develop. and Appl. Program Rev. 1978 p 1-181 - 1-194 (For primary document see N79-25485 16-44)
Avail: NTIS HC A15/MF A01 CSCL 10A

Technical credibility of solar cell power systems is presented. The reduction costs for photovoltaic power systems is discussed. Field tests in the residential demand sector were conducted. S.E.S.

N79-25494*# Army Mobility Equipment Research and Development Center, Fort Belvoir, Va.
MILITARY APPLICATIONS OF PHOTOVOLTAIC SYSTEMS
Donald D. Faehn *In* OAO Corp. Proc. of the US DOE Photovoltaics Technol. Develop. and Appl. Program Rev. 1978 p 1-195 - 1-209 (For primary document see N79-25485 16-44)
(Contract E(49-26)-1031)
Avail: NTIS HC A15/MF A01 CSCL 10A

Applications of solar cell power systems at military facilities are presented. The construction and purpose of these different field test facilities are discussed. S.E.S.

N79-25495*# Solar Energy Research Inst., Golden, Colo. Photovoltaic Program Office.
PHOTOVOLTAIC RESEARCH AND DEVELOPMENT STATUS
D. L. Feucht *In* OAO Corp. Proc. of the US DOE Photovoltaics Technol. Develop. and Appl. Program Rev. 1978 p 1-211 - 1-223 (For primary document see N79-25485 16-44)
Avail: NTIS HC A15/MF A01 CSCL 10A

The goals of the Photovoltaic R&D Program are to develop thin film semiconductor and novel photovoltaic conversion concepts, and to demonstrate the feasibility of producing these cells for a price of $100 - $300 per peak electric output (in 1975) by FY1985. The approaches that are used to determine which research should be funded are formal solicitations, an innovative concepts program which will be launched in FY79, and the review of unsolicited proposals. Author

N79-25496*# Arizona Public Service Co., Phoenix.
PHOTOVOLTAICS AND ENVIRONMENTAL IMPACT CONSIDERATIONS Airport Solar Photovoltaic Concentrator Project
Eric R. Weber *In* OAO Corp. Proc. of the US DOE Photovoltaics Technol. Develop. and Appl. Program Rev. 1978 p 1-225 - 1-267 (For primary document see N79-25485 16-44)
Avail: NTIS HC A15/MF A01 CSCL 10A

An analysis and description is presented for the proposed Airport Solar Photovoltaic Concentrator Project. The environmental effects and potential impacts of the test facilities are discussed. S.E.S.

N79-25497*# United Nations, New York, N. Y.
CHARACTERISTICS OF A TYPICAL VILLAGE IN THE SOLAR BELT OF THE DEVELOPING COUNTRIES OF ASIA, AFRICA, AND LATIN AMERICA
I. H. Usmani *In* OAO Corp. Proc. of the US DOE Photovoltaics Technol. Develop. and Appl. Program Rev. 1978 p 1-269 - 1-283 refs (For primary document see N79-25485 16-44)
Avail: NTIS HC A15/MF A01 CSCL 10A

The economic development of a typical village is presented. The village requirements, basic energy needs of the village, and financing of rural electrification programs are discussed. S.E.S.

N79-25498*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
GAS-TURBINE CRITICAL RESEARCH AND ADVANCED TECHNOLOGY SUPPORT PROJECT Annual Report, FY 1978
John S. Clark, Carl E. Lowell, Richard W. Niedzwiecki, and Joseph J. Nainiger Jun. 1979 46 p refs
(Contract EF-77-A-01-2593)
(NASA-TM-79139; DOE/NASA/2593-79/6; E-9986) Avail: NTIS HC A03/MF A01 CSCL 10B

The technical progress made during the first 15 months of a planned 40-month project to provide a critical-technology data base for utility gas-turbine systems capable of burning coal-derived fuels is summarized. Tasks were included in the following areas: (1) combustion, to study the combustion of coal-derived fuels and conversion of fuel-bound nitrogen to NOx; (2) materials, to understand and prevent hot corrosion; and (3) system studies, to integrate and guide the other technologies. Significant progress was made. G.Y.

N79-25499*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MHD PERFORMANCE CALCULATIONS WITH OXYGEN ENRICHMENT
C. C. P. Pian, P. J. Staiger, and G. R. Seikel 1979 32 p refs Presented at 18th Symp. on Engineering Aspects of Magnetohydrodynamics, Butte, Montana, 18-20 Jun. 1979
(Contract EF-77-A-01-2674)
(NASA-TM-79140; DOE/NASA/2674-79/4; E-9987) Avail: NTIS HC A03/MF A01 CSCL 10A

The impact of oxygen enrichment of the combustion air on the generator and overall plant performance was studied for the ECAS-scale MHD/steam plants. A channel optimization technique is described and the results of generator performance calculations using this technique are presented. Performance maps were generated to assess the impact of various generator parameters. Directly and separately preheated plant performance with varying O2 enrichment was calculated. The optimal level of enrichment was a function of plant type and preheat temperature. The sensitivity of overall plant performance to critical channel

assumptions and oxygen plant performance characteristics was also examined. Author

N79-25500*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMMERCIAL PHOSPHORIC ACID FUEL CELL SYSTEM TECHNOLOGY DEVELOPMENT
Paul R. Prokopius, Marvin Warshay, Stephen N. Simons, and Robert B. King 1979 9 p refs Proposed for presentation at the 14th Intersociety Energy Conversion Engr. Conf., Boston, Mass., 5-10 Aug. 1979
(Contract DE-AI-03-79ET11272)
(NASA-TM-79169; DOE/NASA/11272-79/1; E-034) Avail: NTIS HC A02/MF A01 CSCL 10C

Reducing cost and increasing reliability were the technology drivers in both the electric utility and on-site integrated energy system applications. The longstanding barrier to the attainment of these goals was materials. Differences in approaches and their technological features, including electrodes, matrices, intercell cooling, bipolar/separator plates, electrolyte management, fuel selection, and system design philosophy were discussed. Author

N79-25501*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SOCIAL AND ECONOMIC IMPACT OF SOLAR ELECTRICITY AT SCHUCHULI VILLAGE
William J. Bifano, Anthony F. Ratajczak, Donald M. Bahr (Arizona State Univ., Tempe), and Billy G. Garrett (Arizona State Univ., Tempe) 1979 18 p refs Presented at the Seminar on Solar Technol. in Rural Settings: Assessments of Field Experiences, Atlanta, Ga., 1-2 Jun. 1979; sponsored by United Nations Univ.
(Contract DE-AI-01-79ET20485)
(NASA-TM-79194; DOE/NASA/20485-79/3; E-071) Avail: NTIS HC A02/MF A01 CSCL 10A

Schuchuli, a small remote village on the Papago Indian Reservation in southwest Arizona, is 27 kilometers (17 miles) from the nearest available utility power. Its lack of conventional power is due to the prohibitive cost of supplying a small electrical load with a long-distance distribution line. Furthermore, alternate energy sources are expensive and place a burden on the resources of the villagers. On December 16, 1978, as part of a federally funded project, a solar cell power system was put into operation at Schuchuli. The system powers the village water pump, lighting for homes and other village buildings, family refrigerators and a communal washing machine and sewing machine. J.A.M.

N79-25502*# Contemporary Systems, Inc., Jaffrey, N. H.
SYSTEM INSTALLATION PACKAGE FOR THE NEW HAMPSHIRE VOCATIONAL TECHNICAL COLLEGE, MANCHESTER, N. H.
May 1979 71 p Prepared for DOE
(Contract NAS8-32243)
(NASA-CR-161229) Avail: NTIS HC A04/MF A01 CSCL 10A

A system installed in the residential solar laboratory located at the New Hampshire Vocational Technical College in Manchester, N. H. is described. General guidelines which may be utilized in development of detailed installation plans and specifications, as well as instructions on operation and maintenance are provided. S.E.S.

N79-25503*# Contemporary Systems, Inc., Jaffrey, N. H.
SOLAR HEATING SYSTEM FINAL DESIGN PACKAGE
May 1979 69 p Prepared for DOE
(Contract NAS8-32243)
(NASA-CR-161228) Avail: NTIS HC A04/MF A01 CSCL 10A

The system is composed of a warm air collector, a logic control unit and a universal switching and transport unit. The collector was originally conceived and designed as an integrated roof/wall system and therefore provides a dual function in the structure. The collector serves both as a solar energy conversion system and as a structural weather resistant skin. The control unit provides totally automatic control over the operation of the system. It receives input data from sensor probes in collectors, storage and living space. The logic was designed so as to make maximum use of solar energy and minimize use of conventional energy. The transport and switching unit is a high-efficiency air-handling system equipped with gear motor valves that respond to outputs from the control system. The fan unit was designed for maximum durability and efficiency in operation, and has permanently lubricated ball bearings and excellent air-handling efficiency. R.E.S.

N79-25504*# Northrup, Inc., Hutchins, Tex.
CERTIFICATION AND VERIFICATION FOR NORTHRUP MODEL NSC-01-0732 FRESNEL LENS CONCENTRATING SOLAR COLLECTOR
Mar. 1979 181 p Prepared for DOE
(Contract NAS8-32251)
(NASA-CR-161164) Avail: NTIS HC A09/MF A01 CSCL 10A

Structural analysis and certification of the collector system is presented. System verification against the interim performance criteria is presented and indicated by matrices. The verification discussion, analysis, and test results are also given. R.E.S.

N79-25505*# Spectrolab, Inc., Sylmar, Calif.
SILICON SOLAR CELL PROCESS DEVELOPMENT, FABRICATION AND ANALYSIS Quarterly Report, 28 Aug. - 31 Dec. 1978
1978 10 p Prepared for JPL and DOE
(Contract JPL-955055)
(NASA-CR-158700; DOE/JPL-955055-78/1; JPL-9950-51; QR-1) Avail: NTIS HC A02/MF A01 CSCL 10A

A program plan, baseline process, measurement program and quality control plan were generated. Cutting operations were completed on the silicon sheet material. The first fabrication run of polycrystalline silicon into solar cells by baseline process was completed. Average conversion efficiency for solar cells fabricated by the baseline process from sheet and measured at air mass zero was 10.4%, compared with the control cells, fabricated from single crystal CZ silicon, whose average conversion efficiency was 12.2%. G.Y.

N79-25506*# Pennsylvania Univ., Philadelphia. School of Electrical Engineering.
ANALYSIS AND EVALUATION OF PROCESSES AND EQUIPMENT IN TASKS 2 AND 4 OF THE LOW-COST SOLAR ARRAY PROJECT Quarterly Report, Oct. 1977 - Jan. 1978
H. Goldman and M. Wolf Aug. 1978 118 p refs Sponsored by NASA Prepared for JPL
(Contract JPL-954796)
(NASA-CR-158681; DOE/JPL-954796-77/1; JPL-9950-61) Avail: NTIS HC A06/MF A01 CSCL 10A

Several experimental and projected Czochralski crystal growing process methods were studied and compared to available operations and cost-data of recent production Cz-pulling, in order to elucidate the role of the dominant cost contributing factors. From this analysis, it becomes apparent that the specific add-on costs of the Cz-process can be expected to be reduced by about a factor of three by 1982, and about a factor of five by 1986. A format to guide in the accumulation of the data needed for thorough techno-economic analysis of solar cell production processes was developed. Author

N79-25507*# Hughes Research Labs., Malibu, Calif.
LOW ENERGY PROTON RADIATION DAMAGE TO (AlGa)As-GaAs SOLAR CELLS Final Report, 5 Jul. 1978 - 5 Jan. 1979
Robert Loo, Sanjiv Kamath, and Ronald Knechtli Jan. 1979 106 p refs
(Contract NAS1-15443)
(NASA-CR-159040) Avail: NTIS HC A06/MF A01 CSCL 10A

Twenty-seven 2 times 2 sq cm (AlGa)As-GaAs solar cells were fabricated and subjected to 50 keV, 100 keV, and 290 keV of proton irradiation along with eighteen high efficiency silicon solar cells. The results of the study further corroborate the advantages for space missions offered by GaAs cells over state of the art silicon cells. Thus, even though the GaAs cells showed greater degradation when irradiated by protons with energy less than 5 MeV, the solar cells were normally protected from these protons by the glass covers used in space arrays.

The GaAs cells also offered superior end of life power capability compared with silicon. The change in the open circuit voltage, short circuit current, spectral response, and dark 1-5 characteristics after irradiation at each proton energy and fluence were found to be consistent with the explanation of the effect of the protons. Also dark 1-5 characteristics showed that a new recombination center dominates the current transport mechanism after irradiation. Author

N79-25508# Comptroller General of the United States, Washington, D.C.
LIQUEFIED ENERGY GASES SAFETY. VOLUME 1: EXECUTIVE SUMMARY AND MAIN TEXT Report to the Congress
31 Jul. 1978 618 p refs 3 Vol.
(EMD-78-28-Vol-1) Avail: NTIS MF A01; HC SOD

Liquefied Energy Gas (LEG) safety issues, problem areas, and the actions taken to protect the public were examined. Data are discussed on: (1) LEG storage facilities; (2) LEG transportation; (3) the potential consequences; (4) liability, research, and regulation; and (5) General Accounting Office's recommendations. S.E.S.

N79-25509# Comptroller General of the United States, Washington, D.C.
LIQUEFIED ENERGY GASES SAFETY. VOLUME 2: APPENDIXES Report to the Congress
31 Jul. 1978 470 p refs 3 Vol.
(EMD-78-28-Vol-2) Avail: NTIS MF A01; HC SOD

Listings contained include: (1) the contractors and consultants interviewed, and (2) the facilities and organizations visited. The calculations and experiments are discussed to verify certain assumptions and answers. S.E.S.

N79-25510# Comptroller General of the United States, Washington, D.C.
LIQUEFIED ENERGY GASES SAFETY. VOLUME 3: FEDERAL AGENCY COMMENTS Report to the Congress
31 Jul. 1978 176 p refs 3 Vol.
(EMD-78-28-Vol-3) Avail: NTIS MF A01; HC SOD

Comments made by the Departments of Commerce, Energy, State, and Transportation, the Interstate Commerce Commision, and the National Transportation Safety Board are reported. Disagreements with many of comments are discussed. S.E.S.

N79-25511*# National Aeronautics and Space Administration. Pasadena Office, Calif.
METHOD FOR ANISOTROPICALLY ETCHING A SILICON WAFER HAVING A REINFORCED PERIPHERAL PORTION Patent Application
John A. Scott-Monck (Spectrolab Inc., Sylmar, Calif.) and Charles F. Gay, inventors (to NASA) (Spectrolab Inc., Sylmar, Calif.) Filed 1 Jun. 1979 10 p
(Contract JPL-954600)
(NASA-Case-NPO-14482-1; US-Patent-Appl-SN-044428) Avail: NTIS HC A02/MF A01 CSCL 10A

A method for producing silicon wafers having reinforced peripheral portions for use in the production of silicon solar cells is presented. The method is characterized by the steps of applying to the surface of the central portion of one surface of the silicon wafer to be etched, a mask leaving an exposed peripheral portion of the surface, depositing a layer of metallization on the exposed peripheral portion of the surface, removing the mask from a central portion of the surface and treating the thus exposed surface with an etching fluid for etching the central portion of the wafer to a desired thickness, and thereafter removing the layer of metallization from the surface of the peripheral portion of the cell. NASA

N79-25512*# National Aeronautics and Space Administration. Pasadena Office, Calif.
COPPER DOPED POLYCRYSTALLINE SILICON Patent Application
K. M. Koliwad (JPL) and T. Daud, inventors (to NASA) (JPL) Filed 30 May 1979 12 p
(Contract NAS7-100)
(NASA-Case-NPO-14670-1; US-Patent-Appl-SN-043941) Avail: NTIS HC A02/MF A01 CSCL 10A

It was discovered in accordance with the invention that the presence of copper in polycrystalline silicon solar cells strongly enhances the performance of the cells. It was further discovered that the effect of copper in polycrystalline, silicon solar cells is contrary to that observed in single crystal silicon solar cells, that the effect is greater with smaller grain size and that copper diffused into coarse grained silicon degrades cell performance. NASA

N79-25513# Committee on Science and Technology (U. S. House).
OVERSIGHT ON PHOTOVOLTAIC ENERGY CONVERSION
Washington GPO 1978 140 p refs Hearing before the Subcomm. on Advanced Energy Technologies and Energy Conservation Res., Development and Demonstration of the Comm. on Sci. and Technol., 95th Congr., 1st Sess., 9 Sep. 1977
(GPO-31-624) Avail: Subcomm. on Advanced Energy Technologies and Energy Conservation Res., Development and Demonstration

The technology of photovoltaic array conversion is assessed. Emphasis is placed on reviewing the status of the Low Cost Silicon Solar Array Project. A plan is described of a draft proposal (restructuring an existing program plan) which attempts to improve the odds of reaching a goal of 50 cents per peak watt by 1986. G.Y.

N79-25514# Hughes Aircraft Co., Los Angeles, Calif. Space and Communications Group.
HIGH EFFICIENCY GaAs SOLAR CELL DEVELOPMENT Final Report, 1 Aug. 1976 - 1 Jul. 1978
S. Kamath and G. Wolff Jan. 1979 103 p refs
(Contract F33615-76-C-2121)
(AD-A066616; AFAPL-TR-78-96) Avail: NTIS HC A06/MF A01 CSCL 10/2

Gallium arsenide solar cells were optimized to improve radiation resistance of the cell without loss of efficiency, thus improving the suitability of the cell for space missions. J.M.S.

N79-25515# Honeywell Power Sources Center, Horsham, Pa.
SAFETY STUDIES OF LITHIUM-SULFUR DIOXIDE Final Report, 31 Aug. 1977 - 31 Mar. 1978
L. J. Blagdon and B. Randall Feb. 1979 56 p refs
(Contract DAAB07-77-C-0459)
(AD-A066378; DELET-TR-77-0459F) Avail: NTIS HC A04/MF A01 CSCL 10/3

Hermetically sealed SO2 'D' cells were fabricated and tested to improve safety during use/abuse conditions. Variables evaluated were wrap configurations, cathode processing, cathode density, lithium content and SO2 concentration. At 2A constant current, at -20 F and room temperature, respectively, no venting occurred to 200% of the theoretical SO2 content. Discharge efficiency had the most influence on the safety and cathode development contributed most to improving the overall cell efficiency. Author (GRA)

N79-25516# Army Construction Engineering Research Lab., Champaign, Ill.
THE PERFORMANCE OF AN EXPERIMENTAL SOLAR HEATING SYSTEM
D. M. Joncich, D. J. Leverenz, and D. L. Johnson Feb. 1979 26 p refs
(DA Proj. 4A7-62731-AI-41)
(AD-A066699; CERL-IR-E-144) Avail: NTIS HC A03/MF A01 CSCL 13/1

This report describes the performance of a residential-scale, completely instrumented solar heating system located at the U.S. Army Construction Engineering Research Laboratory (CERL), Champaign, Il. The investigation was made between January 1977 and April 1978. In addition, a daily profile of the performance of the system and its components is presented for a representative sunny winter day. An analysis of the solar system operation indicated that the collector array is by far the most inefficient component in the system for converting incident solar energy into useful heat. The solar system consists of 20 sq m (220 sq ft) of flat-plate, selective surface, singly glazed solar collectors and a 7.6 cu m (2000 gal) equivalent hot water storage tank. The storage system supplies hot water for heating a 50 sq m (540 sq ft) building used by CERL as office space. There is no

domestic hot water in the building. Auxiliary energy is supplied by an electric, flow-through hot water heater. The results of this research are presented in terms of mean daily averages for each month during the heating season and include instantaneous solar radiation (horizontal and in the plane of the collector), useful heat acquired by the collector, useful heat delivered to the thermal storage tank, useful heat delivered to the heating load, thermal storage heat losses, and electrical energy supplied to the pumps. Author (GRA)

N79-25517# Naval Ocean Systems Center, San Diego, Calif.
PERFORMANCE OF PHOTOVOLTAIC CELLS IN AN UNDERSEA ENVIRONMENT Final Report, Mar. - Oct. 1978
J. D. Stachiw 1 Jan. 1979 44 p refs
(ZF61512001)
(AD-A066385; NOSC/TR-359) Avail: NTIS HC A03/MF A01 CSCL 10/2

Photovoltaic solar cells can serve as a reliable source of electric power for electronic instrumentation in temporarily or permanently submerged marine systems in the form of bottom installations, buoys, or remotely controlled unmanned vehicles. The power output of submerged solar cells is a function of solar insolation intensity on the water surface, depth of submersion, optical properties of water, temperature, and the orientation of the cell surface with respect to the sun. Experimental data were generated by submerging solar cell panels in different bodies of water with a 2.5- to 95-ft visual contrast limit, as defined by the observation of a submerged, standard, 12-in Secchi disc, and measuring their performance under load. The power output of horizontally oriented, upward-facing, photovoltaic cells submerged to the visual contrast limit depth was found to be a constant, equal to approximately 5 to 10 percent of the power generated by upward-facing, horizontally oriented cells in an atmospheric environment. The power output of the cells increased at lesser depths, until in the spash zone the output was essentially the same or higher than in the atmospheric environment. Based on these findings it can be concluded that high-efficiency silicon solar cells can serve as a practical electrical power supply in electronic devices for marine applications, if their depth of submersion in less than the visual contrast limit at the dive location. GRA

N79-25518# Aerospace Corp., El Segundo, Calif. Chemistry and Physics Lab.
EVALUATION OF LIQUID-GAS SEPARATOR MATERIALS FOR A SILVER ZINC CELL VENT Final Report
Charles C. Badcock and Albert H. Zimmerman 15 Mar. 1979 20 p refs
(Contract F04701-78-C-0079)
(AD-A067210; TR-0079(4970-10)-2; SAMSO-TR-79-23) Avail: NTIS HC A02/MF A01 CSCL 10/3

The gas permeability of TFE Teflon, FEP Teflon, polyethylene, and microporous Teflon was measured in order to evaluate the suitability of these materials for use as liquid-gas separators for silver zinc cell vents. Microporous Teflon was found to have ideal characteristics for a liquid-gas separator. This material has a high gas permeability, it is not wetted by electrolyte, and it has a negligible permeability to KOH electrolyte. Microporous Teflon is recommended as the material of choice for liquid-gas separators in silver zinc battery cells. Author (GRA)

N79-25519# Edgerton, Germeshausen and Grier, Inc., Albuquerque, N.Mex.
PERFORMANCE TESTING OF THE GENERAL ATOMIC FIXED MIRROR SOLAR CONCENTRATOR
V. E. Dudley and R. M. Workhoven (Sandia Labs., Albuquerque, N. Mex.) May 1978 35 p refs
(Contract EY-76-C-04-0789)
(SAND-78-0624) Avail: NTIS HC A03/MF A01

The testing which was performed on the General Atomic Fixed Mirror Solar Concentrator at the Midtemperature Solar Systems Test Facility is summarized. Test objectives are defined, test procedures are described, and results and conclusions are given. DOE

N79-25520# Edgerton, Germeshausen and Grier, Inc., Albuquerque, N.Mex.
CONCENTRATING SOLAR COLLECTOR TEST RESULTS FROM DOE/SANDIA COLLECTOR MODULE TEST FACILITY
V. E. Dudley and R. M. Workhoven 1978 7 p refs Presented at Sem. on Testing Solar Energy Materials and Systems, Washington, D. C., 22 May 1978 Prepared in cooperation with Sandia Labs., Albuquerque
(Contract EY-76-C-04-0789)
(SAND-78-0881C; Conf-780550-6) Avail: NTIS HC A02/MF A01

A series of concentrating solar collectors are being tested in the Collector Module Test Facility (CMTF). The objective of the test series is to characterize the performance of concentrating solar collectors. Of primary concern is the peak thermal efficiency at solar noon and receiver thermal losses of these collectors over the temperature range from about 100 to 300 C. Five collectors were tested from August 1977 to January 1978, and results of these tests are reported. DOE

N79-25521# Department of Energy, Washington, D. C. Div. of Solar Applications Developments.
SOLAR TECHNOLOGY TRANSFER PROGRAM
Mar. 1978 53 p
(DOE/CS-0027/1) Avail: NTIS HC A04/MF A01

Widespread commercialization of solar energy is discussed. Specific topics covered include: (1) national laboratories regional outreach; (2) installer training and education; (3) information dissemination; (4) workshops, conferences, and exhibits; and (5) consumer representation. DOE

N79-25522# Little (Arthur D.), Inc., Cambridge, Mass.
SOLAR HEATING AND COOLING OF BUILDINGS (SHACOB) COMMERCIALIZATION REPORT, PART B, ANALYSIS OF MARKET DEVELOPMENT. VOLUME 1: EXECUTIVE SUMMARY, SEPTEMBER 1977
May 1978 25 p Sponsored by DOE
(HCP/M70066-01/1-Vol-1) Avail: NTIS HC A02/MF A01

A quantitative model is described which is capable of generating market penetration figures for the solar heating and cooling of buildings under a wide range of assumptions. The results of the model are analyzed and compared with various solar incentive scenarios and data base assumptions.
Author (DOE)

N79-25523# Little (Arthur D.), Inc., Cambridge, Mass.
SOLAR HEATING AND COOLING OF BUILDINGS (SHACOB) COMMERCIALIZATION REPORT, PART B, ANALYSIS OF MARKET DEVELOPMENT. VOLUME 3: APPENDICES, SEPTEMBER 1977
Mar. 1978 58 p Sponsored by DOE
(HCP/M70066-01/3-Vol-3) Avail: NTIS HC A04/MF A01

Appendices are presented which support the analysis of incentives for accelerated commercialization of solar heating and cooling of buildings in the residential and commercial sectors.
DOE

N79-25524# Austrian Solar and Space Agency, Vienna.
METEOROLOGICAL MEASUREMENT DATA FOR SOLAR ENERGY UTILIZATION [METEOROLOGIE MESSDATEN FUER DIE NUTZUNG DER SONNENENERGIE]
G. Braeunlich, M. Bruck, E. Panzhauser, F. Neuwirth, and G. Skoda (Vienna Univ.) Mar. 1977 108 p refs In GERMAN Sponsored by Bundesmin. fuer Wiss. U. Forsch Prepared in cooperation with Zentralanstalt fuer Meteorol. U. Geodyn., Vienna
(ASSA-FA-5) Avail: NTIS HC A06/MF A01

Meteorological parameters relevant to solar energy utilization are defined. Topics discussed include an empirical procedure for approximation of total radiation, an inventory of available measurement data, recommendations for an expanded program of measurement, and standardized data acquisition and data processing. It is concluded that relevant data are available at only a few observation points and the available data are not fully evaluated with respect to requirements oof solar energy users. Appropriate measures are proposed to reduce the data deficit. The meteorological parameters necessary for a precise determination of total radiation are listed. Time series analysis of radiation and meteorological data for Central Austria and

computer storage of these data is recommended in support of a program simulating performance of a solar energy system.J.M.S.

N79-25525# Austrian Solar and Space Agency, Vienna.
STANDARDIZATION OF MEASUREMENT DATA ACQUISITION AND EVALUATION FOR MULTIVALENT SOLAR HEATING SYSTEMS [STANDARDISIERUNG DER MESSWERTERFASSUNG UND AUSWERTUNG BEI MULTIVALENTEN SOLAR - HEIZUNGS - SYSTEMEN]
E. Benes (Tech. Univ., Vienna) and M. Bruck Apr. 1978 32 p ref In GERMAN
(ASSA-SE-B18/77) Avail: NTIS HC A03/MF A01

Operation and performance of the mono- and multivalent, low temperature, solar heating systems were analyzed, using the standardized information program for data acquisition. Three information steps were defined, which permitted (1) determination of the gross and net heat yield, (2) presentation of a detailed energy flow chart of the total system, and (3) acquisition of meteorological data which significantly affects the system behavior. A standardized instrument package was introduced for fully automated measurement and recording of relevant data. Block diagram and schematic front view of the package showed different meter types and the Helio Data 1 acquisition compact instrument. The latter consisted of a magnetic tape recorder, a microterminal, and a microprocessor-controlled data acquisition module. J.A.M.

N79-25526# Austrian Solar and Space Agency, Vienna.
COMPARISON OF COLLECTOR TEST METHODS [VERGLEICH VON KOLLEKTOR-TESTMETHODEN]
P. Varga (Tech. Univ., Vienna) and M. Bruck Dec. 1977 17 p In GERMAN
(ASSA-SE-B24/77) Avail: NTIS HC A02/MF A01

Test methods introduced by the U.S. National Bureau of Standards, the American Society of Heating, Refrigerating, and Air Conditioning Engineers, the West German Labor Council for Solar Energy, and the Swiss Society for Solar Energy are compared with respect to measured variable, procedure specifications, and evaluation of the variables. The variables compared in tabular form are solar irradiation, ambient temperature, wind speed, temperature heat transfer medium, temperature difference at the collector, pressure and pressure differential, and flow rate. Collector and auxiliary equipment specifications are compared in separate tables. Conditions of an indoor test with a solar simulator are tabulated. J.M.S.

N79-25527# Austrian Solar and Space Agency, Vienna.
SOLAR ENERGY MEASURING STATIONS IN AUSTRIA: RESULTS AND EXPERIENCES [SONNENENERGIE - MESSSTATIONEN IN OESTEREICH: ERGEBNISSE UND ERFAHRUNGEN]
Jun. 1978 71 p In GERMAN
(ASSA-SE-INFO-6/78) Avail: NTIS HC A04/MF A01

Solar test stations equipped by the Austrian Federal Ministry of Science and Research are described. The test stations are used to evaluate technological and economic possibilities of direct conversion of solar radiation energy into low temperature heat for swimming pools, houses, and research institutes. Outdoor solar collectors are used for long and short term tests. Results and conclusions drawn from the tests are summarized. It is indicated that standardization of data acquisition and fully automated data recording are the absolute prerequisites for long term observation of polyvalent solar heating systems. Consequently, an instrument package was developed for data acquisition and evaluation. Industrial production of similar instruments was also planned. J.M.S.

N79-25528# Austrian Solar and Space Agency, Vienna.
GLOBAL RADIATION ON RANDOMLY ORIENTED AND INCLINED SURFACES IN AUSTRIA [DIE GLOBALSTRAHLUNG AUF BELIEBIG ORIENTIERTE UND GENEIGTE EBENEN IN OESTERREICH]
M. Bruck, W. Heindl, F. Neuwirth (Zentralanstalt fuer Meteorol. U. Geodyn., Vienna), and G. Schaffar (Tech. Univ., Vienna) Jul. 1978 27 p refs In GERMAN
(ASSA-SE-INFO-7/78) Avail: NTIS HC A03/MF A01

A procedure for the calculation of the correction factor R for global solar radiation on a horizontal surface is described. This factor is used to calculate global radiation on inclined and randomly oriented surfaces, taking into account reflectivity of the terrestrial environment. The estimated reflection coefficients of different surfaces are tabulated. The R values averaged over several months are calculated and compared with the experimental R values for various locations. The calculated average R values are tabulated versus sea level and collector inclination and orientation. J.M.S.

N79-25529# Austrian Solar and Space Agency, Vienna.
THERMAL UTILIZATION OF SOLAR ENERGY IN AUSTRIA. PART 1: HOT WATER PREPARATION, SWIMMING POOL AND SPACE HEATING [THERMISCHE NUTZUNG DER SONNENENERGIE IN SCHWIMMBADHEIZUNG, RAUMHEIZUNG]
Gerhard Faninger and Manfred Bruck Bundesmin. fuer Wiss. U. Forsch. Oct. 1978 90 p In GERMAN
Avail: NTIS HC A05/MF A01

Possibilities and limitations of solar energy technology are discussed, along with meteorological prerequisites for solar energy conversion to heat. Construction and characteristics of solar collectors are detailed, as well as systems for heat generation. Design methods and architectural aspects are briefly reviewed. J.A.M.

N79-25530# Bundesministerium fuer Wissenschaft und Forschung, Vienna (Austria). Research Dept.
SOLAR STREAM IN AUSTRIA [SOLARSTROM IN OESTERREICH]
Norbert Weyss 1977 72 p refs In GERMAN
Avail: NTIS HC A04/MF A01

The procedure for electricity generation in so-called solar power plants combined with pump storage stations is shown. Terrestrial and solar energy sources were considered, along with various possibilities of solar energy utilization, land procurement for energy utilization, and economics of solar power plants. The mechanical power requirement of a solar-hydraulic supply system was examined. Costs of solar power plants vs. fossil fuel plants were estimated. J.A.M.

N79-25531# New Mexico Univ., Albuquerque. Technology Application Center.
FORECASTS OF ENERGY TECHNOLOGY. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1974 - Dec. 1978
Gerald F. Zollars Apr. 1979 47 p Sponsored by NTIS
(NTIS/PS-79/0337/0) Avail: NTIS HC $28.00/MF $28.00 CSCL 10A

The cited articles from worldwide literature concern forecasts of the development of energy technology. Stressed are forecasts relating to new energy sources such as hydrogen-based energy, solar energy conversion and nuclear energy and coal utilization. Economic analyses of various energy conversion techniques are included. GRA

N79-25532# Massachusetts Inst. of Tech., Cambridge. Dept. of Ocean Engineering.
AN EXPERIMENTAL STUDY AND ENGINEERING EVALUATION OF THE SALTER CAM WAVE ENERGY CONVERTER
A. Douglas Carmichael Dec. 1978 80 p refs
(Grant NOAA-04-6-158-44081)
(PB-293603/7; MITSG-78-22; NOAA-79030202) Avail: NTIS HC A05/MF A01 CSCL 10B

The experiments were carried out with a model cam placed in a wave channel and in a towing tank. The tests in the towing tank were with a floating model to simulate ocean conditions. The results indicate that the Salter cam was capable of extracting much of the energy in regular waves and confirmed Salter's findings. From the engineering evaluation it was concluded that there are major unsolved problems associated mainly with the mooring system. The predicted cost of electricity brought to the store was much higher than costs predicted for more conventional methods of electrical power production during the 1990's. GRA

N79-25533# American Physical Society, New York, N. Y.
PRINCIPAL CONCLUSIONS OF THE AMERICAN PHYSICAL SOCIETY STUDY GROUP ON SOLAR PHOTOVOLTAIC

ENERGY
16 Jan. 1979 196 p refs Sponsored in part by DOE
(Contract OSTP-77-13)
(PB-292164/1) Avail: NTIS HC A09/MF A01 CSCL 10B

Those aspects related to solar photovoltaic energy conversion which are of interest to the Department of Energy and the wider technical community are discussed. These include silicon-based and thin-film based solar cell technology, concentrators, systems considerations, perspective on long-term research programs, and some comments on funding formats. GRA

N79-25534# System Planning Corp., Arlington, Va.
A REAL-TIME CASE HISTORY OF ETIP PROJECT 67: INTEGRATED UTILITY SYSTEM APPLICATION Final Report
Jean G. Taylor and Lucius Q. C. Lamar, III Mar. 1978 151 p refs
(Contract NBS-4-416151)
(PB-292770/5; NBS-GCR-ETIP-78-59) Avail: NTIS HC A08/MF A01 CSCL 10A

A feasibility study and conceptual design of the modular integrated utilities system for university medical complexes was undertaken and the findings were presented. The integrated utilities system concept is on-site integration of five basic utility subsystems that serve building complexes electrical power generation; heating and cooling; water supply; sewage treatment; and solid waste disposal. GRA

N79-25535# International Science and Technology Inst., Inc., Washington, D. C.
POTENTIAL USE OF SMALL DAMS TO PRODUCE POWER FOR LOW-INCOME COMMUNITIES
Mary M. Allen 4 Aug. 1978 220 p Prepared in cooperation with Polytechnic Inst. of New York, Brooklyn
(Contract CSA-B8B-5584)
(PB-292745/7) Avail: NTIS HC A10/MF A01 CSCL 10B

An alternative source of energy which would have a stable cost and alleviate the economic strain of rising fossil fuels is the development of small dam sites to produce hydroelectric power. The many issues involved in estimating the potential contribution of hydropower to the energy supply are addressed. The issues discussed include: (1) physical characteristics, (2) environmental and safety considerations, (3) institutional constraints, (4) economic issues, and (5) current governmental programs. GRA

N79-25536# California State Univ., Fullerton.
AN EVALUATION OF THE HYDROTHERMAL RESOURCES OF THE DESERT HOT SPRINGS REGION, CALIFORNIA Final Report
Brent F. Russell Feb. 1979 87 p refs Sponsored by the California Energy Commission, Sacramento
(PB-290942/2; CAEC-23) Avail: NTIS HC A05/MF A01 CSCL 08I

The Desert Hot Springs hydrothermal resource demonstrates its limited capacity to sustain additional utilization and development. The evaluation included the delineation of the areal extent, determination of the hydraulic characteristics, calculation of a safe yield, and identification of the source of heat. GRA

N79-25537# Northwestern Univ., Evanston, Ill. Center for Interdisciplinary Study of Science and Technology.
CONTEXTUAL ANALYSIS FOR INDUSTRIAL ENERGY CONSERVATION R AND D Final Report
Michael Radnor and Durward Hofler Mar. 1978 355 p refs Sponsored by DOE
(Grant NSF PRA-76-SP-1311)
(PB-290981/0; NSF/PRA-76-SP-1311-F) Avail: NTIS HC A16/MF A01 CSCL 10A

The potential usefulness of an analytical technique developed for use by policy makers in a wide variety of R&D and innovation-related situations and sectors was assessed. Operational procedures for identifying critical factors important to program planning and project selection were developed. The technique is expected to be a useful supplement to conventional cost benefit analysis. GRA

N79-25538# Minnesota Energy Agency, St. Paul.
MINNESOTA COAL STUDY
Sep. 1978 137 p Sponsored in part by the Minnesota Dept. of Natural Resources, St. Paul, the Minnesota Dept. of Transportation, St. Paul, the Minnesota Pollution Control Agency, Roseville, and the Minnesota State Planning Agency, St. Paul
(PB-292106/2; MEA/MCS-78) Avail: NTIS HC A07/MF A01 CSCL 10A

An analysis of several interrelated factors relative to consumption, transportation and handling, economic implications, and environmental impacts are studied. GRA

N79-25539# National Bureau of Standards, Washington, D. C. Center for Building Technology.
RESULTS AND ANALYSIS OF A ROUND-ROBIN TEST PROGRAM FOR LIQUID-HEATING FLAT-PLATE SOLAR COLLECTORS
E. R. Streed, W. C. Thomas (Virginia Polytechnic Inst. and State Univ., Blacksburg, Va.), A. G. Dawson, III (Virginia Polytechnic Inst. and State Univ., Blacksburg, Va.), B. D. Wood (Arizona State Univ.), and J. E. Hill Aug. 1978 122 p refs Sponsored in part by DOE
(PB-292115/3; NBS-TN-975) Avail: NTIS HC A06/MF A01 CSCL 10A

A round robin test program was conducted at 21 United States test facilities, using a common test procedure, to determine the intercomparability of thermal performance data pertaining to two liquid-heating flat-plate solar collectors. GRA

N79-25540# General Accounting Office, Washington, D. C. Energy and Mineral Div.
ANALYSIS OF THE ENERGY AND ECONOMIC EFFECTS OF IRANIAN OIL SHORTFALL
Mar. 1979 51 p
(PB-292634/3; EMD-79-38) Avail: NTIS HC A04/MF A01 CSCL 10A

A partial listing of topic areas included the following: the size of the shortfall; international aspects; effects on the U. S. economy; government options. GRA

N79-25111*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN ENERGY DATA BASE PRELIMINARY DESIGN
E. R. Cole, L. O. Herrera, and D. M. Lascu *In its* The Deep Space Network 15 Jun. 1979 p 167-181 refs (For primary document see N79-25088 16-12)
Avail: NTIS HC A11/MF A01 CSCL 10B

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N79-25541 Stanford Univ., Calif.
PARTICLE AGGLOMERATION INDUCED BY ALTERNATING ELECTRIC FIELDS Ph.D. Thesis
Masaaki Kobashi 1979 229 p
Avail: Univ. Microfilms Order No. 7912382

An experimental and analytical study of a method for increasing the fractional efficiency of electrostatic precipitators for the collection of the near and sub-micron size fly ash particles produced by coal-fired electric power plants was presented. In the analytical phase of the study, numerical methods were used to calculate the collision efficiencies of two charged particles colliding in the presence of an applied electric field, accounting in some detail for both aerodynamic and electrical interactions. In the experimental phase of the work, a bench-scale alternating electric field agglomeration test apparatus was constructed and systematic experiments were conducted to investigate the effects of mass loading, unipolar vs. bipolar charging, frequency of the AC field, and residence time in the agglomerator. Dissert. Abstr.

N79-25542 Florida Univ., Gainesville.
NITROGEN MASS BALANCES IN FLORIDA ECOSYSTEMS Ph.D. Thesis
Jay James Messer 1978 437 p
Avail: Univ. Microfilms Order No. 7913305

Nitrogen mass balance models were investigated as instruments for the assessment and management of nitrogen as an environmental pollutant. Nitrogen balances were constructed for three Florida ecosystems, and field and laboratory data were collected to estimate or verify the magnitude of nitrogen fluxes in the systems. A sugarcane field in the Everglades Agriculture Area, a large lake (L. Okeechobee), and the entire Florida peninsula were chosen as prototype systems. The peninsula model was constructed by combining the results of separate hydrological, agricultural, and atmospheric submodels. Dissert. Abstr.

N79-25543# Council for Scientific and Industrial Research, Pretoria (South Africa). Committee for Terrestrial Biology.
NYLSVLEY: A SOUTH AFRICAN SAVANNA ECOSYSTEM PROJECT: OBJECTIVES, ORGANIZATION AND RESEARCH PROGRAMME
B. J. Huntley Mar. 1978 44 p refs
(OSIR-Rept-27; ISBN-0-7988-1311-3) Avail: NTIS HC A03/MF A01

A description of the objectives, organization and research program of the Savanna Ecosystem Project being undertaken at Nylsvley in the northern Transvaal is presented. The project is a cooperative multi-disciplinary study of the structure and function of a savanna ecosystem being undertaken by researchers from seven universities and several government institutes. The program commenced with a pilot study of the main research area (Phase 1, 1974-1976) and current activities focus on the investigation of key components and processes (Phase 2, 1976-1979). Author

N79-25544# National Aviation Facilities Experimental Center, Atlantic City, N. J.
EXHAUST EMISSIONS CHARACTERISTICS FOR A GENERAL AVIATION LIGHT-AIRCRAFT AVCO LYCOMING 10-360-A1B6D PISTON ENGINE Final Report
Eric E. Becker Feb. 1979 94 p refs
(FAA Proj. 201-521-100)
(AD-A066556; FAA-NA-78-49; FAA-RD-78-142) Avail: NTIS HC A05/MF A01 CSCL 13/2

A steady state exhaust emissions data base was developed. This data base consisted of current production baseline emissions characteristics, lean-out emissions data, effects of leaning-out the fuel schedule on cylinder head temperatures, and data showing ambient effects on exhaust emissions and cylinder head temperatures. The engine operating with its current full-rich production fuel schedule did not meet the proposed Environmental Protection Agency (EPA) standard for carbon monoxide (CO) under sea level, standard-day conditions. The engine did, however, meet the proposed EPA standards for unburned hydrocarbons (HC) and oxides of nitrogen (NOx) under the same sea level test conditions. The results of testing the engine under different ambient conditions (hot day) were also presented, and these results showed a trend toward higher levels of emissions output for CO and HC while producing slightly lower levels of NOx. Author

N79-25545# National Aviation Facilities Experimental Center, Atlantic City, N. J.
EXHAUST EMISSIONS CHARACTERISTICS FOR A GENERAL AVIATION LIGHT-AIRCRAFT AVCO-LYCOMING 10-360-B1BD PISTON ENGINE Final Report
Eric E. Becker Feb. 1979 91 p refs
(FAA Proj. 201-521-100)
(AD-A066589; FAA-NA-78-28; FAA-RD-78-129) Avail: NTIS HC A05/MF A01 CSCL 13/2

A steady state exhaust emissions data base was developed. This data base consisted of current production baseline emissions characteristics, lean-out emissions data, effects of leaning-out the fuel schedule on cylinder head temperatures, and data showing ambient effects on exhaust emissions and cylinder head temperatures. The engine operating with its current full-rich production fuel schedule did not meet the proposed Environmental Protection Agency (EPA) standard for carbon monoxide (CO) and unburned hydrocarbons (HC) under sea level standard-day conditions. The engine did, however, meet the proposed EPA standards for oxides of nitrogen (NOx) under the same sea level conditions. The results of engine testing under different ambient conditions were also presented, and these results showed a trend toward higher levels of emissions output for CO and HC while producing slightly lower levels of NOx. R.E.S.

N79-25546*# Virginia Polytechnic Inst. and State Univ., Blacksburg.
ELECTRON SPECTROSCOPY FOR CHEMICAL ANALYSIS (ESCA) STUDY OF ATMOSPHERIC PARTICLES Final Report
John G. Dillard, Roland D. Seals, and James P. Wightman Jun. 1979 81 p refs
(Contract NAS1-13175)
(NASA-CR-3153) Avail: NTIS HC A05/MF A01 CSCL 13B

The results of analyses by ESCA (Electron Spectroscopy for Chemical Analysis) on several Nuclepore filters which were exposed during air pollution studies are presented along with correlative measurements by Neutron Activation Analysis and Scanning Electron Microscopy. Samples were exposed during air pollution studies at Norfolk, Virginia and the NASA Kennedy Space Center (KSC). It was demonstrated that with the ESCA technique it was possible to identify the chemical (bonding) state of elements contained in the atmospheric particulate matter collected on Nuclepore filters. Sulfur, nitrogen, mercury, chlorine, alkali, and alkaline earth metal species were identified in the Norfolk samples. ESCA binding energy data for aluminum indicated that three chemically different types of aluminum are present in the launch and background samples from NASA-KSC. Author

N79-25547# Committee on Merchant Marine and Fisheries (U. S. House).
OCEAN DUMPING AND POLLUTION
Washington GPO 1978 501 p refs Hearings on H.R. 4715, H.R. 5282, H.R. 5851 and S. 1617 before the Subcomm. on Oceanography and the Subcomm. on Fisheries and Wildlife Conservation and the Environment of the Comm. on Merchant Marine and Fisheries, 95th Congr., 20 Sep. 1977; 1 Feb. 1978; 3 Oct. 1977; 15 May, 11 and 24 Jul. 1978
(GPO-33-546) Avail: Subcomm. on Oceanography

Testimonies from witnesses are given on the following topics: (1) ocean dumping; (2) nuclear waste disposal; (3) ocean pollution research; and (4) marine sanctuaries. The text of three bills (H.R. 4715, H.R. 5282 and H.R. 5851) is also given. G.Y.

N79-25548# Naval Civil Engineering Lab., Port Hueneme, Calif.
DETERMINATION OF OIL IN WATER BY ORGANIC CARBON ANALYSIS Final Report, Apr. 1972 - Sep. 1977
Peter J. Hearst Jan. 1979 38 p refs
(ZF61512001)
(AD-A066302; CEL-TN-1541) Avail: NTIS HC A03/MF A01 CSCL 13/2

A method was investigated for determination of oil in water by establishing the organic carbon content attributable to the oil and by converting this value to the oil content. Samples were homogenized with the aid of an emulsifier, and a correction was made for the carbon contributed by the emulsifier. Aliquots of 35 micros l or less were injected into the organic carbon analyzer because larger samples were incompletely combusted and gave reduced recoveries. With corrections for carbon content of the water or the seawater used to prepare the samples, samples containing 15 mg/l of white mineral oil or Navy distillate fuel gave recoveries of about 85% with standard deviations of about 10%. Samples of about 50 mg/l gave recoveries of about 65%. If the factor of 1.39, instead of the theoretical factor of 1.18, had been used to convert from carbon to oil content, the calculated recoveries would have been 100% for 15 mg/l oil samples and 76% for 50 mg/l oil samples. The method will give only an upper limit for the oil concentration unless a correction is made for dissolved organic materials. Author (GRA)

N79-25549# Missouri Univ. - Columbia. Environmental Trace Substances Research Center.
METHODOLOGY FOR COLLECTING AND ANALYZING ORGANIC AIR POLLUTANTS Final Report
Corazon Hastings Vogt Feb. 1979 64 p refs
(Grant EPA-R-801050)
(PB-292285/4; EPA-600/2-79-042) Avail: NTIS HC A04/MF A01 CSCL 07D

A number of support-bonded liquid phase sorption media were developed and evaluated in model systems for collecting

and analyzing organic air pollutants. Polymers with various functional groups were synthesized and chemically bonded onto inert supports in thick layers. A media consisting of a silicone liquid bonded to Chromosorb W was used with excellent results. Retention times of most organic compounds on this liquid were extremely long at ambient temperatures, and sampling can be carried out for 24 hours at a rate of 10 liters of air per minute. In contrast, subsequent counter current liquid extraction took only a few minutes since retention volumes were very small. Extracts were analyzed largely by gas chromatography. GRA

N79-25550# Civil and Environmental Engineering Development Office, Tyndall AFB, Fla. Detachment 1 ADTC.
AIRCRAFT AIR POLLUTION EMISSION ESTIMATION TECHNIQUES, ACEE Final Report, Aug. 1977 - Aug. 1978
Harold A. Scott, Jr. and Dennis F. Naugle 1 Sep. 1978 12 p refs
(AF Proj. 2103)
(AD-A067262; CEEDO-TR-78-33) Avail: NTIS HC A02/MF A01 CSCL 13/2

A five-step analytical methodology is presented that can be adapted to nearly any aircraft related air quality assessment problem. The methodology is for use by base level environmental personnel to calculate: (1) annual aircraft emissions, and (2) downfield pollutant concentrations. The latest individual engine emission factors and other information required for the methodology are contained in this report. Author (GRA)

N79-25551# Water Research Centre, Stevenage (England).
TESTS FOR ASSESSING THE OXYGEN DEMAND OF EFFLUENTS
Feb. 1978 4 p refs
(WRC-RN-14) Avail: NTIS HC A02/MF A01

The most commonly used tests are discussed with the purpose of outlining their differences so that the most appropriate test may be selected for any given application. Methods discussed are permemgenate value, biochemical oxygen demand, chemical oxygen demand, total oxygen demand, and total organic carbon. Author (ESA)

N79-25552# Water Research Centre, Stevenage (England).
APPLICATIONS OF MASS SPECTROMETRY IN POLLUTION CONTROL
Jun. 1978 4 p refs
(WRC-RN-16) Avail: NTIS HC A02/MF A01

Mass spectrometry coupled with gas chromatography and data processing is a powerful analytical tool for organic analysis. Typical systems and their applications to pollution control are discussed. In particular, the identification of polycyclic aromatic hydrocarbons in sludge, herbicides in effluents, and of organic residues in carbon treated effluents as well as other applications are discussed. Author (ESA)

N79-25553# Water Research Centre, Stevenage (England).
[WATER RESEARCH ACTIVITIES FOR 1977-78] Annual Report, 1977-78
1978 110 p ref Sponsored by Dept. of Energy, Engl.
Avail: NTIS HC A06/MF A01

A description of the 1977/78 activities of the Water Research Council is given. Research activities and installation facilities are commented on. A list of technical publications and articles generated by the WRC is included. Author (ESA)

N79-25554# Water Research Centre, Stevenage (England). Lab. Services Div.
SUMMARY OF WRC EQUIPMENT DEVELOPED FOR BIOLOGICAL MONITORING OF WATER QUALITY
V. Wordingham Apr. 1978 20 p
(WRC-OR-12) Avail: NTIS HC A02/MF A01

The use of fish to detect changes in the quality of river waters and effluents was examined. Several aspects of fish behavior were monitored for this purpose. The small electrical signals produced by the muscles during movement of the heart and the opercula, and during general body movement, were studied. The equipment that has been produced for use in the research program is described. Author (ESA)

N79-25555# GEOMET, Inc., Gaithersburg, Md.
INDOOR AIR POLLUTION IN THE RESIDENTIAL ENVIRONMENT. VOLUME 1: DATA COLLECTION, ANALYSIS AND INTERPRETATION Final Report
Demetrios J. Moschandreas, John W. C. Stark, James E. McFadden, and Sallie S. Morse Dec. 1978 204 p refs Sponsored in part by HUD
(Contract EPA-68-02-2294)
(PB-290999/2; GEOMET-EF-688-Vol-1;
EPA-600/7-78-229A-Vol-1) Avail: NTIS HC A10/MF A01 CSCL 21D

Continuous sampling was carried out for CO, SO2, NO, NO2, CO2, CH4, and THC, TSP, RSP, SO=4, NO-3, Pb, ammonia, and aldehydes were monitored intermittently. Aerosol samples were collected for elemental analysis by the roton induced X-ray emission technique. In addition, data on energy parameters, infiltration rates, and family activities were obtained by observations, field experiments, and daily questionnaires respectively. The observed indoor air pollutant concentrations were, on the average, not very high; however, persistent moderate and, at times, elevated pollutant levels were observed. GRA

N79-25556# GEOMET, Inc., Gaithersburg, Md.
INDOOR AIR POLLUTION IN THE RESIDENTIAL ENVIRONMENT. VOLUME 2: FIELD MONITORING PROTOCOL, INDOOR EPISODIC POLLUTANT RELEASE EXPERIMENTS AND NUMERICAL ANALYSES Final Report
Demetrios J. Moschandreas Dec. 1978 244 p refs Sponsored in part by HUD
(Contract EPA-68-02-2294)
(PB-291000/8; GEOMET-EF-688-Vol-2;
EPA-600/7-78-229B-Vol-2) Avail: NTIS HC A11/MF A01 CSCL 21D

The experimental monitoring design for obtaining continuous and intermittent air samples under real-life conditions was described. The site selection criteria, monitoring techniques, data management system and quality assurance program were discussed in detail. Specific experiments of episodic contaminant release in the indoor residential environment were also discussed. The monitoring technique and the data obtained from it were presented. Finally, numerical techniques used to determine the sensitivity coefficients of the indoor-outdoor air pollution model was detailed. GRA

N79-25557# Hittman Associates, Inc., Columbia, Md.
AIR EMISSIONS FROM COMBUSTION OF SOLVENT REFINED COAL Final Report, Mar. 1977 - Sep. 1978
Kenneth G. Budden and Subhash S. Patel Jan. 1979 48 p refs
(Contract EPA-68-02-2162)
(PB-290946/3; HIT/C165/860-78-733D2;
EPA-600/7-79-004) Avail: NTIS HC A03/MF A01 CSCL 07D

Details of a Solvent Refined Coal (SRC) combustion test are given. Flue gas samples were collected for modified EPA Level 1 analysis; analytical results are reported. Air emissions from the combustion of coal and SRC are compared for various organic and inorganic constituents, and SO2 and NOx. The impact of the air emissions from the combustion of SRC is assessed by comparison with EPA's multimedia environmental goals and existing new source performance standards. Air quality emissions test data indicated that SRC SO2 and NOx emissions were 1.06 and 0.43 lb/million Btu, respectively; or about 12 and 39% under the existing NSPS of 1.2 lb/million Btu for NOx. GRA

N79-25558# Mitre Corp., McLean, Va. METREK Div.
ENTROPY (AVAILABLE ENERGY) ANALYSIS, ENERGY AND ENVIRONMENTAL CONTROL APPLICATIONS
Daniel Schiff 1978 82 p refs
(Grant NSF ENV-77-17101)
(PB-292073/4; MTR-7999; NSF/RA-780272) Avail: NTIS HC A05/MF A01 CSCL 07D

Two types of second law analysis represented extremes in considering the relative merits of alternative energy and pollution control technologies. An analysis of a flue gas desulfurization system on an existing coal fire plant shows that the bus bar available energy for its pollution control scrubber is less than

the bus bar available energy for the scrubber modified with a heat recovery unit. An analysis of available energy and costs compares a present power plant operation including a flue gas desulfurization (FGD) system, a power plant without an FGD system, and a power plant with an FGD system and additional heat exchangers replacing the reheaters. GRA

N79-25559# Battelle Columbus Labs., Ohio.
ENHANCED SO3 EMISSIONS FROM STAGED COMBUSTION Final Report, Jul. 1977 - Apr. 1978
Earl L. Merryman and Arthur Levy Jan. 1979 27 p refs
(Grant EPA-R-805330-01-1)
(PB-292522/0; EPA-600/7-79-002) Avail: NTIS HC A03/MF A01 CSCL 07D

Methane flames doped with H2S were used to examine staging effects, employing a small quartz tube two-stage combustor. Examination of the staged combustion process suggests that the high CO levels produced in the first stage may pump a sufficient level of oxygen atoms into the second stage to increase SO3 formation. The results further suggest that the enhancement is small and may only be a transient early postflame phenomenon dependent on several combustion variables. The kinetic analysis shows that enhancement of SO3 formation can occur in staged combustion. GRA

N79-25560# Illinois Univ., Urbana.
KINETICS OF SULFUR DIOXIDE IN AQUEOUS SOLUTION Final Report, Apr. 1973 - Dec. 1974
J. L. Hudson, J. Erwin, and N. M. Catipovic Jan. 1979 82 p refs
(Grant EPA-R-800303)
(PB-292709/3; EPA-600/7-79-030) Avail: NTIS HC A05/MF A01 CSCL 07D

The rate of oxidation (low pH catalyzed oxidation and high pH uncatalyzed oxidation) of SO2 in a 1 liter semibatch reactor was investigated. Low pH experiment results showed that both MgSO4- and MnSO4-catalyzed liquid phase oxidation of SO2 at low pH was zero order in SO2 concentration. The primary result of the high pH study was a first order rate constant of 0.0053 per second; during the experiments, oxidation was kinetically controlled with a constant oxidation concentration of 0.0013 M. Results applied to conditions in a SO2 scrubber indicated that the catalyst effect, even at ppm concentration was very significant. The effect of catalysts in high pH scrubbing systems subject to oxidation was much greater than in low pH systems. GRA

N79-25561# Florida State Univ., Tallahassee. Dept. of Physics.
PROTON SCATTERING ANALYSIS FOR LIGHT ELEMENTS IN AIR PARTICULATE MATTER Final Report, May 1974 - Jul. 1978
J. William Nelson, G. M. Hudson, H. C. Kaufmann, W. J. Courtney, and I. Williams Nov. 1978 59 p refs
(Grant EPA-R-802913)
(PB-292726/7; EPA-600/2-78-213) Avail: NTIS HC A04/MF A01 CSCL 07D

Proton scattering analysis was developed to provide light element analyses as a complementary method to X-ray analysis. Samples of air particulate matter from both filter and impaction devices were analyzed and time sequence and particle size information obtained. In combination with X-ray analysis, total mass may be determined by summation of elemental masses; however, further investigation is needed to compare with the gravimetric method. Like X-ray analysis, it has a broad range, and is rapid, subject to automation, and nondestructive of the prepared sample. Analyses of typical atmospheric samples may be performed in five minutes or less. With further development, the method can readily be advanced from experimental to routine usage. GRA

N79-25562# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.
WORKBOOK FOR COMPARISON OF AIR QUALITY MODELS
May 1978 113 p refs
(PB-292249/0; EPA-450/2-78-028A) Avail: NTIS HC A06/MF A01 CSCL 04A

The workbook describes a technique for the qualitative comparison of modeling approaches on technical grounds. The methodology is based upon an applications approach. The results of the model comparison depend upon the application for which the model is to be used as well as upon the model characteristics. In each application of the technique, the model of interest is compared with a reference model. Any model may be specified as the reference model, as long as it is compatible with the application of interest. GRA

N79-25563# TRW Systems Group, Redondo Beach, Calif.
TRW CHARGED DROPLET SCRUBBER CORROSION STUDIES Final Report, Aug. 1977 - Oct. 1978
Frederick A. Whitson Jan. 1979 163 p refs
(Contract EPA-68-02-2613)
(PB-290898/6; EPA-600/7-79-017) Avail: NTIS HC A08/MF A01 CSCL 13B

The corrosive nature of coke-oven waste heat flue gas and its effects on wet electrostatic precipitators, specifically the charged droplet scrubber (CDS), were investigated. The chemical composition of the waste heat flue gases was characterized and related to corrosion and to the effects on the electrostatic scrubbing mechanism. Materials compatibility with the coking process waste heat environment was evaluated and candidate agents were identified which may be introduced into the waste heat gas stream to minimize the corrosive effects. It was determined that, with several equipment and operating modifications, projected life of the CDS casing and internals is 5 to 10 years, and life expectancy of the electrode nozzles is 1 to 2 years. GRA

N79-25564# Rockwell International Corp., Creve Couer, Mo. Air Monitoring Center.
REGIONAL AIR POLLUTION STUDY. POINT SOURCE METHODOLOGY AND EMISSION INVENTORY Final Report
F. E. Littman Jul. 1978 160 p refs
(Contract EPA-68-02-2093)
(PB-290921/1; EPA-600/4-78-042) Avail: NTIS HC A08/MF A01 CSCL 13B

The development of the point source emission data inventory for the Regional Air Pollution Study at St. Louis is discussed. To meet the unusual requirements of this study, which specified the acquisition of hourly, measured emission data for the St. Louis Air Quality Control Region for a period of two years, a unique methodology was developed and put into practice. The result is a data base containing over 20 million pieces of information in a readily accessible form. GRA

N79-25565# Oklahoma Univ., Norman. School of Civil Engineering and Environmental Science.
THE ROLE OF STREAMS IN POLLUTION DILUTION AND DISPERSION Final Technical Completion Report, 1 Oct. 1977 - 30 Sep. 1978
Homero Silva and Jimmy F. Harp Sep. 1978 45 p refs
(Contract DI-14-34-0001-8038)
(PB-290935/6; W79-04118; OWRT-A-083-OKLA(1)) Avail: NTIS HC A03/MF A01 CSCL 13B

Rock Creek at Sulphur, Oklahoma, was studied to determine the existing water quality, and to measure water quality of selected points along the stream. The Rock Creek watershed area is described along with beneficial uses and water quality, hydrology of the creek, and sources of pollution to the creek. Mathematical modeling of natural water bodies is discussed and mathematical models to the three sampling stations are presented. Each model with its statistical analysis for validity is presented. It is concluded that modeling of the stream is statistically accurate, and that simulation of different conditions is reliable. GRA

N79-25566# Notre Dame Univ., Ind.
PROCEEDINGS: SYMPOSIUM ON NEW CONCEPTS FOR FINE PARTICLE CONTROL Progress Report, Jan. 1977 - Jul. 1978
Teoman Ariman, comp. Aug. 1978 464 p refs Symp. held at Notre Dame, Ind., 20-22 Apr. 1977
(Grants EPA-R-805148; NSF ENG-77-02016)
(PB-292095/7; EPA-600/7-78-170) Avail: NTIS

HC A20/MF A01 CSCL 13B

Presentations made during a symposium on novel concepts, methods, and advanced technology in particulate/gas separation are reported. The symposium, held at the University of Notre Dame and sponsored by the National Science Foundation and the Environmental Protection Agency, was held both to identify new research areas and to stimulate future research activities. GRA

N79-25567# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.

AIR POLLUTANT EMISSION FACTORS FOR MILITARY AND CIVIL AIRCRAFT Final Report, Aug. 1977 - Apr. 1978

D. Richard Sears Oct. 1978 91 p refs

(Contract EPA-68-02-2614)

(PB-292520/4; LMSC-HREC-TR-D568208; EPA-450/3-78-117) Avail: NTIS HC A05/MF A01 CSCL 13B

Tables of military aircraft fuel characteristics, aircraft classifications, military and civil times in mode, engine modal emission rates, and aircraft emission factors per landing-takeoff cycle are calculated and compiled. The data encompass 59 engines and 89 aircraft. Information related to benzo(a)pyrene emissions and to hydrocarbon emissions (volatile organic) with potential to produce photochemical oxidant is discussed. GRA

N79-25568# Industrial Environmental Research Lab., Research Triangle Park, N. C.

CASCADE IMPACTOR DATA REDUCTION WITH SR-52 AND TI-59 PROGRAMMABLE CALCULATORS Technical Report, May - Jun. 1978

Leslie E. Sparks Nov. 1978 114 p refs

(PB-290710/3; EPA-600/7-78-226) Avail: NTIS HC A06/MF A01 CSCL 13B

Useful tools were provided for obtaining particle size distributions and graded penetration data from cascade impactor measurements. The programs calculated impactor aerodynamic cut points, total mass collected by the impactor, cumulative mass fraction less than for each stage, log-normal size distribution parameters for the data, and graded penetration. These programs were written for the Texas Instruments SR-52 and TI-59 programmable calculators, and the PC-100A printer. A general discussion of the program, an example problem, program listing, and user instructions are provided for each program. GRA

N79-25569# Environmental Protection Agency, Research Triangle Park, N.C.

NATIONAL EMISSIONS REPORT (1974): NATIONAL EMISSIONS DATA SYSTEM OF THE AEROMETRIC AND EMISSIONS REPORTING SYSTEM Annual Report

Jul. 1978 439 p

(PB-292252/4; EPA-450/2-78-026) Avail: NTIS HC A19/MF A01 CSCL 13B

The annual cumulative estimates of source emissions of five criteria pollutants: particulates, sulfur oxides, nitrogen oxides, hydrocarbons, and monoxide are presented. Summary data are presented for the nation as a whole, for individual states, and for air quality control regions and individual interstate portions. The data compilations result from the operations of the national emissions data system, which functions as a component of the comprehensive EPA air information system--the aerometric and emissions reporting system. GRA

N79-25570# Beck (R. W.) and Associates, Denver, Colo.

A PRIMER ON THE REJECTION OF WASTE HEAT FROM POWER PLANTS Final Report

Robert D. Mitchell and Randy D. Horsek May 1978 49 p

(EPRI Proj. 927-1)

(PB-292529/5; CAEC-30) Avail: NTIS HC A03/MF A01 CSCL 13A

The workings and importance of cooling systems in power plants are described. Many of the terms used in the energy industry are defined. The cost and efficiency of various waste heat rejection systems (cooling systems), such as once-through circulating systems, cooling ponds and lakes, spray ponds, and wet and dry cooling towers are discussed. The effects of cooling systems on the environment, and on the production and cost of electricity, are considered. GRA

N79-25571# Olson Labs., Inc., Anaheim, Calif.

EXHAUST EMISSIONS FROM VEHICLES IN DEMAND-RESPONSIVE SERVICE

John A. Gunderson Mar. 1978 158 p refs

(Contract EPA-68-03-2411)

(PB-292486/8; EPA-460/3-78-004) Avail: NTIS HC A08/MF A01 CSCL 13B

Demand responsive service vehicles were tested to measure exhaust emissions. Each vehicle was exhaust emission tested using the FTP for Light-Duty Vehicles: the Surveillance Driving Sequence, including steady-state modes; and the AA-1 Urban Bus Cycle. Each vehicle was run at 'typical' inertia loads for all test procedures and 'fully loaded' for the AA-1 cycle. Emission data collected and reported is used by the emission factors group of ECTD to estimate emissions inventories for this class of vehicles. GRA

N79-25572# KVB Engineering, Inc., Tustin, Calif.

APPLICATION OF COMBUSTION MODIFICATIONS TO INDUSTRIAL COMBUSTION EQUIPMENT, DATA SUPPLEMENT B Report, Jan. 1976 - Jan. 1978

K. T. Fisher, H. J. Buening, W. A. Carter, P. K. Engel, S. C. Hunter, and R. J. Tidona Feb. 1979 446 p ref

(Contract EPA-68-02-2144)

(PB-292880/2; KVB-6002-734A; EPA-600/7-79-015C) Avail: NTIS HC A19/MF A01 CSCL 13B

Tested were 22 units, including refinery process heaters; clay and cement kilns; steel and aluminum furnaces; boilers burning black liquor, woodbark, and CO gas; internal combustion engines; and gas turbine combined cycles. Process variables, fuel types, excess air reduction, burner adjustments, and staged combustion were evaluated primarily for their effect on NOx emissions. Emissions of NOx, SOx, CO, and HC were measured in all units. Emissions of particulate mass and size, trace species, and organics were measured on selected units. GRA

N79-25573# Air Pollution Technology, Inc., San Diego, Calif.

ALTERNATIVES FOR HIGH-TEMPERATURE/HIGH-PRESSURE PARTICULATE CONTROL Final Report, Oct. 1977 - Oct. 1978

Richard Parker and Seymour Calvert Jan. 1979 137 p refs

(Contract EPA-68-02-2190)

(PB-292687/1; EPA-600/7-79-019) Avail: NTIS HC A07/MF A01 CSCL 13B

Anticipated performance and development problems were discussed. Efficiency and potential economic advantages of the HTP particulate control over cold gas cleanup in pressurized fluidized-bed combustion (PFBC) and low-Btu coal gasification (LBCG) combined-cycle power generation systems were discussed. The alternative of recuperative heat exchange coupled with low-temperature/high-pressure particulate control was viewed with regard to power system efficiencies or PFBC and LBCG combined-cycle processes. GRA

N79-25574# ETA Engineering, Inc., Westmont, Ill.

ECONOMIC IMPACT OF THE PROPOSED CHANGE IN THE HYDROCARBON EMISSION LIMITATION FOR PETROCHEMICAL MANUFACTURING PROCESS Final Report

John J. Yates, Rajan K. Chaudhry, Kevin G. Croke, William H. Hallenbeck, and William H. Kojola Oct. 1978 100 p refs

Sponsored by Ill. Inst. of Natural Resources

(PB-290917/4; IINR-78/30) Avail: NTIS HC A05/MF A01 CSCL 13B

The present Rule 205(g) (1) of Chapter 2 of the Illinois Pollution Control Board's Regulations limits organic material emissions from: (a) any catalyst regenerator of a petroleum cracking system; or (b) any petroleum fluid coker; or (c) any other waste gas stream from any petroleum or petrochemical manufacturing process; to 100 parts per million (ppm). The proposed amendment basically gives the operator of the organic material source the option to meet the stringent requirements of Rule 205(f). Rule 205(f) requires that the source meet the emission limitation of either 8 pounds per hour or reduce the uncontrolled organic emissions by at least 85 percent provided that there will be no increase in emissions from such sources above the level of emissions in existence on the effective date of R77-3. GRA

N79-25575# Southern Research Inst., Birmingham, Ala.
PERFORMANCE AND ECONOMIC EVALUATION OF A HOT-SIDE ELECTROSTATIC PRECIPITATOR Final Report, Dec. 1976 - Sep. 1978
G. H. Marchant, Jr. and J. P. Gooch Nov. 1978 195 p refs
(Contract EPA-68-02-2185)
(PB-292648/3; SORI-EAS-78-415; EPA-600/7-78-214) Avail: NTIS HC A09/MF A01 CSCL 13B

Measurements of fractional efficiency were conducted across the entire electrostatic precipitator (ESP). In situ and laboratory resistivity measurements were performed, and voltage-current characteristics of the power supplies were obtained. An engineering analysis was conducted, including an estimate of the specific collecting area required for a cold-side ESP on the same boiler. GRA

N79-25576# SRI International Corp., Menlo Park, Calif.
CONTINUOUS READING LIDAR TECHNIQUE FOR MEASURING PLUME OPACITY Final Report, Jun. 1974 - Sep. 1976 1976
Dilip G. Saraf Feb. 1979 56 p refs
(Contract EPA-68-02-1291)
(PB-292330/8; EPA-600/2-79-023) Avail: NTIS HC A04/MF A01 CSCL 13B

The development of a laser radar (lidar) instrument for remote measurement of the opacity of smoke-stack plumes is described. Two lidar measurement methods were studied for the instrument continuous wave (CW) lidar and high pulse rate lidar. The evaluation showed that the CW lidar could remotely measure the opacities of screen targets or smoke generator plumes at night to within 3% opacity at a distance of approximately 80 meters. Proof-of-principle experiments were performed to demonstrate the feasibility of using a high pulse rate lidar for plume opacity measurements. However, the lidar was capable of measuring the opacity of the screen targets at close range (40m) and by placing a small artificial scattering target in the atmosphere behind them. GRA

N79-25577# New York Sea Grant Inst., Albany.
STABILIZATION OF SUBTIDAL SEDIMENTS BY THE TRANSPLANTATION OF THE SEAGRASS ZOSTERA MARINA L
A. Coolidge Churchill, Anthony E. Cok, and Michael I. Riner 1978 48 p refs Prepared in cooperation with Texas Instruments, Inc., Dallas, Tex. and Adelphi Univ.
(PB-293639/1; NYSSGP-RS-78-15; NOAA-79030712) Avail: NTIS HC A03/MF A01 CSCL 13B

The seagrass Zostera marina was successfully transplanted onto dredge spoil, and the method has potential for stabilizing unconsolidated sediments. The recommended transplanting technique uses miniplugs, sediment-free clusters of 4 to 6 shoots, together with entangled roots and rhizomes, which are planted manually without anchoring devices. A total of 4,061 miniplugs were planted in an area of 0.06 hectares (0.14 acres) with 80 percent survival. A 2- and 3-fold increase in rhizome length and shoot number, respectively, occurred during the first 4 months. The cost of planting 0.41 hectares (1 acre) is estimated at $3,370. GRA

N79-25578# Stanford Univ., Calif. Dept. of Civil Engineering.
ENVIRONMENTAL CONSIDERATIONS IN WATER RESOURCES PLANNING BY THE BUREAU OF RECLAMATION
James E. Price and Leonard Otrolano Dec. 1978 306 p refs
(Grant NSF PRA-75-22340)
(PB-292547/7; SU-IPM-8; NSF/PRA-7522340/3) Avail: NTIS HC A14/MF A01 CSCL 13B

The extent to which environmental factors influence decision making at the project planning level in offices of the U.S. Bureau of Reclamation is examined. An effort was made to determine the extent to which the hypotheses suggested by previous Stanford research on the Corps of Engineers and the Soil Conservation Service were relevant to the planning of water resources projects by the Bureau. The research consisted of casting these hypotheses in operational terms and subjecting them to testing by examining them in the light of information on 29 Bureau planning investigations carried out by 12 Bureau offices. The way in which water resources development planning is currently conducted in the regional and field offices of the Bureau is described. A discussion is presented on the three dependent variables defined and measured in this investigation. GRA

N79-25579# Missouri Univ. -Rolla.
REMOVAL OF AMMONIA NITROGEN FROM WASTEWATER BY PARTIAL CHLORINATION FOLLOWED BY ACTIVATED CARBON TREATMENT Completion Report, Jul. 1976 - Sep. 1978
Ju-Chang Huang Nov. 1978 120 p refs
(Contracts DI-14-31-0001-7053; DI-14-34-0001-7054)
(PB-292502/2; W79-04556; OWRT-A-093-MO(1)) Avail: NTIS HC A06/MF A01 CSCL 13B

The feasibility of removing NH3-N from waste water by first converting it to chloramines by partial chlorination and then removing the latter by activated carbon treatment is investigated. It is concluded that the technique is not very effective in removing ammonia from waste water. GRA

N79-25580# Automotive Testing Labs., Inc., Aurora, Colo.
COLORADO MOTOR VEHICLE EMISSION INSPECTION: A PILOT PROGRAM Final Report
Douglas R. Liljedahl and Jerry L. Terry Mar. 1978 476 p
(Contract EPA-68-03-2593)
(PB-292651/7; EPA-460/3-78-001) Avail: NTIS HC A21/MF A01 CSCL 13B

A series of emission and fuel economy tests were performed on a sample of passenger cars and light duty trucks. Tests were performed on the vehicles in their as-received condition. Many of these vehicles that failed an idle test during the initial test sequence were delivered to one of ten preselected repair and tune-up facilities for corrective maintenance. Idle emission tests and maintenance actions were performed at the repair facilities before the vehicles were returned to the laboratory. These were followed by another series of tests at the laboratory to provide information on the effectiveness of the work performed. GRA

N79-25581# State Univ. of New York at Stony Brook. Marine Sciences Research Center.
ENVIRONMENTAL EFFECTS OF SAND MINING IN THE LOWER BAY OF NEW YORK HARBOR, PHASE 1
Kim A. Kastens and Charles T. Fray Sep. 1978 148 p refs Sponsored by NOAA
(PB-293585/6; SR-15) Avail: NTIS HC A07/MF A01 CSCL 08I

An introduction to the continuing investigation of the sand and gravel resources of Lower New York Harbor is presented. The report consists of: (1) an annotated bibliography and critical review of all pertinent literature; (2) a collection and interpretation of all pertinent existing data; (3) textural data for new sediment samples collected from East Bank and adjacent areas east of Ambrose Channel, and a limited number of samples from West Bank; and (4) results of a preliminary geophysical survey of Lower New York Harbor. The objective of this study was to develop a predictive capability for assessing the environmental impacts that would result from a variety of sand and gravel mining activities; different techniques of mining, different rates and patterns of removal; and to use this information to develop appropriate plans for management of this resource. GRA

N79-25582# Manhattan Coll., New York. Environmental Engineering and Service Program.
ESTIMATE OF NEW YORK BIGHT FUTURE (2000) CONTAMINANT INPUTS Final Report
Andrew R. Anderson and James A. Mueller 1978 33 p refs
(Grant NOAA-04-6-022-44027)
(PB-293571/6; NOAA-79022709) Avail: NTIS HC A03/MF A01 CSCL 13B

Future waste loads of selected water quality parameters from various sources are estimated and compared with present load values and waste source distribution for the New York Bight. Present waste load estimates for the years 1972-1973 are available and in this report 'present' is defined as that time period. Future means the period of approximately the year 2000, which is relevant to available population projections and allows enough time for completion of currently planned treatment facilities. GRA

N79-25583# Ford Aerospace and Communications Corp., Newport Beach, Calif. Aeronutronic Div.
MULTIWAVELENGTH TRANSMISSOMETER FOR MEASURING MASS CONCENTRATION OF PARTICULATE EMISSIONS Final Report, Jul. 1975 - May 1978
Eli Reisman Feb. 1979 64 p refs
(Contract EPA-68-02-2206)
(PB-292108/8; EPA-600/2-79-022) Avail: NTIS HC A04/MF A01 CSCL 14B

A multiwavelength transmissometer potentially capable of making near-real-time measurements of particulate mass concentration in industrial stacks was developed. A computer program is employed to interpret the transmissometer data and translate the results into mass concentration. The theory behind the measurement technique, a laboratory demonstration of the technique, and the optical and electrical design of the instrument are discussed. GRA

N79-25584# Environmental Protection Agency, Research Triangle Park, N.C.
CONTROL OF VOLATILE ORGANIC EMISSIONS FROM EXISTING STATIONARY SOURCES. VOLUME 8: GRAPHIC ARTS, ROTOGRAVURE AND FLEXOGRAPHY
Edwin J. Vincent and William M. Vatavuk Dec. 1978 64 p refs
(PB-292490/0; EPA-450/2-78-033; OAQPS-1.2-109) Avail: NTIS HC A04/MF A01 CSCL 14E

Guidance is provided for development of regulations to limit emissions of volatile organic compounds from rotogravure and flexographic printing operations. This guidance includes recommended control requirements for carbon adsorption and incineration systems which represent Reasonably Available Control Technology for these operations. Provisions for the potential compliance by use of water-borne and high-solids inks are recommended. The industry is described, methods for reducing organic emissions are reviewed, and monitoring and enforcement aspects are discussed. GRA

N79-25585# Acurex Corp., Mountain View, Calif. Energy and Environmental Div.
DESIGN AND CONSTRUCTION OF A FLUIDIZED-BED COMBUSTION SAMPLING AND ANALYTICAL TEST RIG Final Report, Aug. 1976 - Apr. 1978
H. Dehne Aug. 1978 141 p refs
(Contract EPA-68-02-2170)
(PB-290914/1; EPA-600/7-78-166) Avail: NTIS HC A07/MF A01 CSCL 14B

The design, construction, and installation of a fluidized-bed coal combustion sampling and analytical test rig is described. The rig, to be used to investigate the emission characteristics of fluidized-bed combustors, was designed for maximum flexibility, accuracy, and utility. The program included four phases: conceptual design; final design; purchase, fabrication, and installation; and checkout, testing, and documentation. After installation, an acceptance test demonstrated that the system was completed in accordance with the approved design, and that all equipment was properly installed and corrected to serve its intended purpose. GRA

N79-25586# Institute of Industry of Cement Building Materials, Opole (Poland).
FILTRATION PARAMETERS FOR DUST CLEANING FABRICS Final Report, Jun. 1973 - Dec. 1978
J. R. Koscianowski, Lidia Koscianowska, and Eugeniusz Szczepankiewicz Jan. 1979 225 p Sponsored by EPA
(PB-272381/1; EPA-600/7-79-031) Avail: NTIS HC A11/MF A01 CSCL 13K

Laboratory and pilot scale testing of bag filter fabrics is described. Filtration performance data and mathematical modeling parameters are given for four Polish fabrics tested with cement dust, coal dust, flyash, and talc. GRA

N79-25587# National Oceanic and Atmospheric Administration, Boulder, Colo. Marine Ecosystems Analysis Program.
MESA NEW YORK BIGHT PROJECT Annual Report, Fiscal Year 1977
Oct. 1978 143 p
(PB-293519/5; NOAA-79022704) Avail: NTIS HC A07/MF A01 CSCL 13B

The research results of the project focused on specific environmental issues which are highlighted under the following topics: contaminants of the New York Bight; New York Bight anoxia; sewage sludge dumping; and dredge spoil dumping. GRA

N79-25588# Southwest Research Inst., San Antonio, Tex.
ANALYTICAL PROCEDURES FOR CHARACTERIZING UNREGULATED POLLUTANT EMISSIONS FROM MOTOR VEHICLES Interim Report, Mar. 1977 - Oct. 1978
Harry E. Dietzmann, Lawrence R. Smith, Mary Ann Parness, and E. Robert Fanick Feb. 1979 497 p refs
(Contract EPA-68-02-2497)
(PB-292093/2; EPA-600/2-97-017) Avail: NTIS HC A21/MF A01 CSCL 07D

Analytical procedures are described that may be used to assess motor vehicle emission rates of several unregulated pollutants including aldehydes, organic amines, sulfur dioxide, nitrous oxide, several individual hydrocarbons including benzene, hydrogen sulfide, total cyanide, organic sulfides, nickel carbonyl, ammonia, sulfate, and N-nitrosodimethylamine (sampling conditions only). A series of validation experiments involving motor vehicle exhaust with injects of known quantities of the compounds of interest and the Constant Volume Sampling system commonly used in emissions certification are described for several of the analytical procedures. GRA

N79-25589# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.
GUIDELINE FOR THE INTERPRETATION OF OZONE AIR QUALITY STANDARDS
Thomas C. Curran Jan. 1979 41 p refs
(PB-292271/4; EPA-450/4-79-003) Avail: NTIS HC A03/MF A01 CSCL 13B

The interpretation of the national ambient air quality standards (NAAQS) for ozone that were promulgated by the U. S. Environmental Protection Agency was discussed. These standards differed from previous NAAQS in that attainment decisions were based upon the expected number of days per year above the level of the standard. The data analysis implications of the statistical formulation of an air quality standard were presented for both compliance assessment and design value estimation purposes. Example calculations were included. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N79-25590 British Library Lending Div., Boston Spa (England).
FOUR-DIMENSIONAL ANALYSIS OF ASYNCHRONIC OBSERVATIONS
Ye. L. Metelitsa 6 Nov. 1978 15 p refs Transl. from Tr. Gidrometeorol. Nauchno-Issled Tsent. SSSR (Leningrad), no. 197, 1977 p 73-83
(BLL-Trans-1371-(9022.549)) Avail: British Library Lending Div., Boston Spa, Engl.

A paper is presented which proposes a method of four-dimensional analysis based on optimal space-time interpolation, sets forth information on how the method was applied by computer, and analyses the computed results in conjunction with observed data. Simultaneous use of data from different sources (aerological observations, satellite measurements) forms the essence of the approach. G.Y.

N79-25591 Colorado School of Mines, Golden.
GRAVITATIONAL TECTONIC AND STATIC SEISMIC MODELING WITH FINITE ELEMENTS Ph.D. Thesis
Lawrence John Barrows 1978 153 p
Avail: Univ. Microfilms Order No. 7912211

At least some, and possibly most, tectonic activity results from gravity acting on crustal and upper mantle density structures. Finite element techniques were adapted to analyze the tectonic

implications of some simple density structures. The techniques are first tested on a model of the diapiric rise of a salt ridge into a more dense overburden. Both the wavelength and rate of rise of the modeled ridge compare favorably with the analytical solution. Dissert. Abstr.

N79-25592 Illinois Univ. at Urbana-Champaign, Urbana.
A MULTIVARIATE ANALYSIS OF THE GEOMETRIC FORM RELATIONSHIPS AMONG A SET OF GEOMORPHOMETRIC VARIABLES DESCRIBING VALLEY-SIDE ASYMMETRY Ph.D. Thesis
Donald E. Luman 1978 226 p
Avail: Univ. Microfilms Order No. 7913535

Utilizing USGS topographic maps as the primary data source, research was conducted on 526 stream valley segments situated on the Illinoian till plain of western Illinois. These stream valleys are located in two large drainage basins and range from almost symmetrical to very asymmetrical in form. In addition they also represent all directional aspects. An electronic digitizer collected the height information for 2,630 cross-valley profiles; and a specially developed computer program employing a spline-fitting algorithm calculated the moment measure statistics for each frequency distribution of height, slope, curvature, and aspect. Analysis of these data using factor analysis demonstrates a significant cross-valley difference in geometric form exists for opposing valley-side slopes. Dissert. Abstr.

N79-25593 Institut d'Aeronomie Spatiale de Belgique, Brussels.
SOLAR ULTRAVIOLET RADIATION AND ITS RELATIONS WITH AERONOMY [LE RAYONNEMENT ULTRAVIOLET DU SOLEIL ET SES RELATIONS AVEC L'AERONOMIE]
P. C. Simon 1977 25 p refs In FRENCH; ENGLISH summary Presented at CNES 'Journees sur l'atmosphere', Meudon, France, 27-29 Sep. 1976 Submitted for publication
(Aeronomica-Acta-A-179-1977) Avail: Issuing Activity

Solar irradiation fluxes between 30 and 350 nm are briefly reviewed and discussed. Discrepencies between recent observations are pointed out, showing the urgent need of new measurements in this wavelength range for aeronomic purposes, especially to study the atmospheric effect of solar variability during the eleven year cycle. The use of Spacelab to solve these problems is emphasized. Author (ESA)

N79-25594 Institut d'Aeronomie Spatiale de Belgique, Brussels.
STRATOSPHERIC METHANE-MEASUREMENTS AND PREDICTIONS
M. Ackerman, D. Frimout, and C. Muller 1977 28 p refs Presented at IAGA-IAMAP Assemblies, Seattle, Sep. 1977 Submitted for publication
(Aeronomica-Acta-A-180-1977) Avail: Issuing Activity

A determination of stratospheric methane levels from 22 to 35 km alt using high resolution infrared absorption spectroscopic measurements interpreted on the basis of presently available laboratory spectroscopic data and with implications on the abundance of this constituent at greater heights is presented. Previous measurements, some of which show large discrepancies with currently admitted values, were reinterpreted and brought into agreement. The results are in contradiction, according to present theories, with the in situ determined CH4 abundances at the upper edge of the stratosphere. Author (ESA)

N79-25595 Institut d'Aeronomie Spatiale de Belgique, Brussels.
STRATOSPHERIC POLLUTION RELATED ULTRAVIOLET RADIATION PHENOMENA
M. Ackerman 1977 22 p refs Submitted for publication
(Aeronomica-Acta-A-181-1977) Avail: Issuing Activity

A short review of ultraviolet phenomena related to stratospheric pollution is presented. Major aspects such as solar flux, attenuation of solar radiation, photodissociation, and stratospheric species analysis in the ultraviolet are highlighted with recent examples. The importance of data obtained between 1970 and 1977 on solar ultraviolet radiation is emphasized. Author (ESA)

N79-25596 Institut d'Aeronomie Spatiale de Belgique, Brussels.
THE ACTION OF CHLORINE ON THE OZONE LAYER AS GIVEN BY A ZONALLY AVERAGED TWO-DIMENSIONAL MODEL
G. Brasseur and M. Bertin (SNIAS, Paris) 1978 28 p refs Presented at IAGA-IAMAP Conf., Seattle, Aug. 1977 Submitted for publication
(Aeronomica-Acta-A-187-1978) Avail: Issuing Activity

In order to study the behavior of stratospheric minor constituents related to aeronomic processes and atmospheric transport in the meridional plane a numerical two-dimensional model was established dealing mainly with the action of chlorine compounds and the influence of hydrogen and nitrogen species. This model was applied to the study of chlorine compounds in the stratosphere. Special attention was devoted to the effect in the ozonosphere of an increase of ClX due to anthropogenic activities. Author (ESA)

N79-25597 Institut d'Aeronomie Spatiale de Belgique, Brussels.
MEASUREMENTS OF EFFECTIVE ABSORPTION CROSS SECTIONS IN THE ULTRAVIOLET REGION: DESCRIPTION OF THE EXPERIMENTAL SYSTEM
J. Wisemberg and N. Vanlaethem-Meuree 1978 18 p refs In FRENCH; ENGLISH summary Presented at Session of the Classe des Sci. de l'Acad. Roy. de Belg., Belg., 4 Feb. 1978 Submitted for publication
(Aeronomica-Acta-A-190-1978) Avail: Issuing Activity

The technical method, operation, and performance of an instrument for laboratory measurements of absorption cross sections in the spectral ultraviolet range are described. Details are given for an application to atmospheric constituents. Author (ESA)

N79-25598 Institut d'Aeronomie Spatiale de Belgique, Brussels.
ABSORPTION OF CHLOROMETHANES IN THE ULTRAVIOLET REGION. MEASUREMENTS OF ABSORPTION CROSS SECTIONS AS A FUNCTION OF TEMPERATURE [ABSORPTION DES CHLOROMETHANES DANS L'ULTRAVIOLET: MESURE DES SECTIONS EFFICACES D'ABSORPTION EN FONCTION DE LA TEMPERATURE]
N. Vanlaethem-Meuree, J. Wisemberg, and P. C. Simon 1978 20 p refs In FRENCH; ENGLISH summary Presented at Classe des Sci. de l'Acad. Roy. de Belg., Belg., 4 Feb. 1978
(Aeronomica-Acta-A-191-1978) Avail: Issuing Activity

The absorption cross sections of chloromethanes leading to their photodissociation by ultraviolet radiation in the stratosphere are presented for spectral ranges of 2 nm and 500 per/cm, respectively, and from 175 to 250 nm. They are then compared with results of other authors. The temperature effects on the absorption cross sections near the threshold were also investigated. Author (ESA)

N79-25599 Institut d'Aeronomie Spatiale de Belgique, Brussels.
TEMPERATURE INFLUENCE ON EFFECTIVE ABSORPTION CROSS SECTIONS OF CHLOROFLUOROMETHANES IN THE ULTRAVIOLET REGION [INFLUENCE DE LA TEMPERATURE SUR LES SECTIONS EFFICACES D'ABSORPTION DES CHLOROFLUOROMETHANES DANS L'ULTRAVIOLET]
N. Vanlaethem-Meuree, J. Wisemberg, and P. C. Simon 1978 19 p refs In FRENCH; ENGLISH summary Presented at Session of the Classe des Sci. de l'Acad. Roy. de Belg., Belg., 4 Feb. 1978 Submitted for publication
(Aeronomica-Acta-A-192-1978) Avail: Issuing Activity

The ultraviolet absoprtion spectrums of CF3Cl, CF2Cl2, and CFCl3 were studied from 175 to 220 nm at various temperatures. Absorption cross sections for T = 296 K, 279 K, and 255 K are presented for spectral intervals of 2 nm and 500 per/cm, respectively. The temperature effects on the absorption cross section values are discussed and compared with results obtained by other authors. Author (ESA)

N79-25600 Institut d'Aeronomie Spatiale de Belgique, Brussels.
A DYNAMIC EFFECT IN THE IONOSPHERIC F1 LAYER
C. Taieb (Centre de Rech. en Phys. de l'Environ. Terrestre et Planetaire, Issy-les Moulineaux, France), G. Scialom (Centre de Rech. en Phys. de l'Environ. Terrestre et Planetaire, Issy-les-Moulineaux, France), and G. Kockarts 1978 35 p refs Submitted for publication
(Aeronomica-Acta-A-194-1978) Avail: Issuing Activity

Incoherent scatter observations of the ionospheric F1 layer above Saint-Santin (44.6 deg N) were analyzed after correction of a systematic error at 165 and 180 km altitude. The daytime valley observed around 200 km during summer for low solar

activity conditions is explaned in terms of a downward ionization drift which reaches 30 m/sec around 180 km. Experimental determination of the ion drift confirms the theoretical characteristics required for the summer daytime valley as well as for the winter behavior without a valley. The computations require an effective dissociative recombination rate of 23 million cu cm/sec (also corrected for absolute temperature) and ionizing fluxes compatible with solar activity conditions at the time when the valley is observed. Author (ESA)

N79-25601 Institut d'Aeronomie Spatiale de Belgique, Brussels.
IN SITU MEASUREMENTS OF MIDDLE ATMOSPHERE COMPOSITION
M. Ackerman 1978 26 p refs Presented at Intern. Symp. on Solar-Terrest. Phys., Innsbruck, 29 May - 3 Jun. 1978 Submitted for publication
(Aeronomica-Acta-A-195-1978) Avail: Issuing Activity

Experimental data based on aircraft, balloon, and rocket measurements of trace species in the middle atmosphere are briefly reviewed. Some ground based observations are also included where no other information is available. The scarcity of values relevant to the vertical composition distributions is emphasized as well as the lack of knowledge of tome and geographic variabilities necessary to understand the physical and chemical properties of the middle atmosphere and to monitor its stability over long periods of time. Author (ESA)

N79-25602*# Aerospace Corp., Los Angeles, Calif. Space Sciences Lab.
STUDIES IN UPPER AND LOWER ATMOSPHERE COUPLING Final Report
Y. T. Chiu, C. J. Rice, and L. R. Sharp Mar. 1979 229 p
(Contract NASw-3120)
(NASA-CR-158654; ATR-79(9553)-6) Avail: NTIS HC A11/MF A01 CSCL 04A

The theoretical and data-analytic work on upper and lower atmosphere coupling performed under a NASA Headquarters contract during the period April 1978 to March 1979 are summarized. As such, this report is primarily devoted to an overview of various studies published and to be published under this contract. Individual study reports are collected as exhibits. Work performed under the subject contract are in the following four areas of upper-lower atmosphere coupling: (1) Magnetosphere-ionosphere electrodynamic coupling in the aurora; (2) Troposphere-thermosphere coupling; (3) Ionosphere-neutral-atmosphere coupling; and (4) Planetary wave dynamics in the middle atmosphere. G.Y.

N79-25603*# Pacific Soils Engineering, Inc., Harbor City, Calif.
GEOTECHNICAL INVESTIGATION REPORT FOR PROPOSED ARRAY OF SIX 40-METER DIAMETER ANTENNAS, PIONEER SITE, DSS 11, GOLDSTONE, CALIFORNIA TRACKING COMPLEX
Joseph S. Sweitzer 1 Apr. 1979 211 p refs Prepared for JPL
(Contract JPL-955295)
(NASA-CR-158715) Avail: NTIS HC A10/MF A01 CSCL 08G

The geotechnical investigation was conducted in three disciplines: (1) geological field reconnaissance of the general area of proposed construction; (2) geophysical seismic refraction survey of the localized area surrounding the six proposed antenna sites, including shear wave velocity determination; and (3) detailed foundation engineering investigation of each of the six sites. The investigations indicate that the six sites selected are relatively free from geologic hazards which would inhibit the proposed construction or future antenna operations. R.E.S.

N79-25604*# George Washington Univ., Washington, D. C.
STUDIES OF RADIATIVE TRANSFER IN THE EARTH'S ATMOSPHERE WITH EMPHASIS ON THE INFLUENCE OF THE RADIATION BUDGET IN THE JOINT INSTITUTE FOR ADVANCEMENT OF FLIGHT SCIENCES AT THE NASA-LANGLEY RESEARCH CENTER Annual Report, 1 Aug. 1978 - 31 Jul. 1979
1979 23 p
(Grant NsG-1555)
(NASA-CR-158690) Avail: NTIS HC A02/MF A01 CSCL 04A

Earth and solar radiation budget measurements were examined. Sensor calibration and measurement accuracy were emphasized. Past works on the earth's radiation field that must be used in reducing observations of the radiation field were reviewed. Using a finite difference radiative transfer algorithm, models of the angular and spectral dependence of the earth's radiation field were developed. R.E.S.

N79-25605*# Lamont-Doherty Geological Observatory, Palisades, N. Y.
STRAIN BUILDUP AND RELEASE. EARTHQUAKE PREDICTION AND SELECTION OF VLB SITES FOR THE MARGINS OF THE NORTH PACIFIC Semiannual Progress Report
C. H. Scholz and T. L. Johnson Jun. 1979 11 p refs
(Grant NGR-33-008-146)
(NASA-CR-158689) Avail: NTIS HC A02/MF A01 CSCL 08K

Projects studying different aspects of crustal deformation are discussed. The rifting process at the plate boundary in northern Iceland was investigated using combined seismic, tilt, and displacement measurements. Stresses acting on the Alpine fault, New Zealand, were modeled based on observations of regional variation in metamorphism and argon loss. The relationship between the stress pattern shown by intraplate seismicity and possible stresses on plates arising from litohspheric motion over the asthenosphere was investigated. Small earthquakes in Southern California were studied to determine if subregions of uniform strain release exist and if interaction occurs between faults. R.E.S.

N79-25606*# National Aeronautics and Space Administration, Washington, D. C.
PROBLEMS WITH THE INTERPRETATION OF PALEOMAGNETIC MEASUREMENTS DUE TO STUDIES OF BASALTS FROM THE PALEOVOLCANO VOGELSBERG IN HESSEN
E. Schenk Jun. 1979 31 p refs Transl. into ENGLISH from Z. Geophys. (West Germany), v. 36, 1970 p 359-385 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75355) Avail: NTIS HC A03/MF A01 CSCL 08G

The palaeomagnetic parameters of more than 5,000 samples of cores taken from 33 drilling holes through innumerable basalt units of the Vogelsberg Paleovolcano in Hessen were measured. Measurements of specimens of thin and thick layers without any gap proved that inclination, natural remanence, susceptibility and Konigsberger factor were dependent on their distance from the surface of units, layers, lamelles, etc. Therefore, representative data for the evaluation of palaeomagnetic measurements can be expected only in the interior part of lava flows and intrusions. The statistic method which enclosed all values of measurements gave significant data which was not appropriate for the interpretation of palaeomagnetic and geological events. R.E.S.

N79-25607*# National Aeronautics and Space Administration, Washington, D. C.
ALTITUDES OF THE LOWER EDGE OF THE ARTIFICIAL AURORAL RAYS ON THE BASIS OF THE OBSERVATIONS IN THE ZARNITSA-2 EXPERIMENTS
T. G. Adeyshvili, N. I. Dzyubenko, V. E. Dorofeyev, V. N. Ivchenko, P. F. Lazorenko, S. B. Lyaknov, G. G. Managadze, and G. P. Milinevskiy Jun. 1979 12 p refs Transl. into ENGLISH from Vysoty Nishnego Kraya Iskuss tvennykh Avroral'nykh Luchey po Bazisnym Nablyudeniyam v Eksperimente Zarnitsa-2 (Moscow), PR-424, 1978 15 p Transl. by Scientific Translation Service, Santa Barbara, Calif. Original document prepared by Academy of Sciences USSR, Moscow
(Contract NASw-3198)
(NASA-TM-75631) Avail: NTIS HC A02/MF A01 CSCL 04A

Some results of optical television measurements in the Zarnitsa-2 experiment are presented. The altitudes of the lower edge of artificial auroral rays were determined by the triangulation method and are compared with theoretical calculations of these altitudes based on the Jacchia and CIRA models of the atmosphere. Author

N79-25608*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MIDDLE ATMOSPHERE ELECTRODYNAMICS: REPORT OF THE WORKSHOP ON THE ROLE OF THE ELECTRODYNAMICS OF THE MIDDLE ATMOSPHERE ON SOLAR TERRESTRIAL COUPLING
Nelson C. Maynard, ed. Jun. 1979 268 p refs Workshop held at Reston, Va., 17-19 Jan. 1979
(NASA-CP-2090) Avail: NTIS HC A12/MF A01 CSCL 04A

Significant deficiencies exist in the present understanding of the basic physical processes taking place within the middle atmosphere (the region between the tropopause and the mesopause), and in the knowledge of the variability of many of the primary parameters that regulate Middle Atmosphere Electrodynamics (MAE). Knowledge of the electrical properties, i.e., electric fields, plasma characteristics, conductivity and currents, and the physical processes that govern them is of fundamental importance to the physics of the region. Middle atmosphere electrodynamics may play a critical role in the electrodynamical aspects of solar-terrestrial relations. As a first step, the Workshop on the Role of the Electrodynamics of the Middle Atmosphere on Solar-Terrestrial Coupling was held to review the present status and define recommendations for future MAE research. For individual titles, see N79-25609 through N79-25618.

N79-25609*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MIDDLE ATMOSPHERE ELECTRODYNAMICS: REPORT OF THE WORKSHOP ON THE ROLE OF THE ELECTRODYNAMICS OF THE MIDDLE ATMOSPHERE ON SOLAR TERRESTRIAL COUPLING
In its Middle Atmosphere Electrodyn. Jun. 1979 p 1-25 (For primary document see N79-25608 16-46)
Avail: NTIS HC A12/MF A01 CSCL 04A

The middle atmosphere (MA), which is defined as the region bounded below by the tropopause near 10 km and above by the mesopause near 90 to 100 km, is regarded as a passive medium through which electric fields and currents are transmitted from sources above and below. A scientific background is given for: sources of MA electric fields; MA conductivity and currents; and MA plasma characteristics. Recommendations are given for research in MA electrodynamics in the following areas: (1) MA electrodynamical parameters; (2) models and supportive laboratory measurements; and (3) investigation of specific problems in the coupled systems. G.Y.

N79-25610*# National Oceanic and Atmospheric Administration, Boulder, Colo. Aeronomy Lab.
THE MIDDLE ATMOSPHERE
G. C. Reid *In* NASA. Goddard Space Flight Center Middle Atmosphere Electrodyn. Jun. 1979 p 27-42 refs (For primary document see N79-25608 16-46)
Avail: NTIS HC A12/MF A01 CSCL 04A

A quick introduction to some of the important electrical properties, and to the factors that influence them and their variability are provided. The following topics are discussed: (1) production of ionization; (2) ion concentration; (3) ion composition; and (4) variability of the various sources of middle atmospheric ionization. G.Y.

N79-25611*# Maryland Univ., College Park. Inst. for Physical Science Technology.
DIRECT ENERGY INPUTS TO THE MIDDLE ATMOSPHERE
T. J. Rosenberg and L. J. Lanzerotti (Bell Laboratories, Murray Hill, N.J.) *In* NASA. Goddard Space Flight Center Middle Atmosphere Electrodyn. Jun. 1979 p 43-70 refs (For primary document see N79-25608 16-46)
Avail: NTIS HC A12/MF A01 CSCL 04A

As a working definition of the extent of the middle atmosphere (MA), the height range from 30 to 100 km was adopted. The neutral and ionic composition and the dynamics within this height range are, for the most part, poorly understood. From available information, the importance of various particle and photon energy sources, including their variability, for ionization of the neutral atmosphere in this height range is assessed. The following topics are discussed: (1) penetration of the MA by particle and electromagnetic energy; (2) ionization sources for the MA; (3) galactic cosmic rays; (4) solar H Ly alpha, other EUV, and X-rays; (5) magnetospheric electrons and bremsstrahlung X-rays; and (6) solar cosmic rays. G.Y.

N79-25612*# National Oceanic and Atmospheric Administration, Boulder, Colo. Aeronomy Lab.
ION CHEMISTRY OF THE MIDDLE ATMOSPHERE
Eldon E. Ferguson *In* NASA. Goddard Space Flight Center Middle Atmosphere Electrodyn. Jun. 1979 p 71-88 refs (For primary document see N79-25608 16-46)
Avail: NTIS HC A12/MF A01 CSCL 04A

Difficulties in making in situ and laboratory measurements of the ion composition of the middle atmosphere are related. An approach is presented which entends theoretical and laboratory results for both negative and positive ions from the D-region down to the stratosphere. In each case, the extension of data from the D-region 'down' to the higher pressure stratosphere is primarily a matter of inquiring into the role of the minor constituents whose absolute concentrations become large enough to allow them to become involved in the ion chemistry. A.R.H.

N79-25613*# National Center for Atmospheric Research, Boulder, Colo.
SOLAR-TERRESTRIAL COUPLING THROUGH ATMOSPHERIC ELECTRICITY
R. G. Roble and P. B. Hays (Michigan Univ., Ann Arbor) *In* NASA. Goddard Space Flight Center Middle Atmosphere Electrodyn. Jun. 1979 p 89-139 refs Sponsored in part by NSF (For primary document see N79-25608 16-46)
Avail: NTIS HC A12/MF A01 CSCL 04A

There are a number of measurements of electrical variations that suggest a solar-terrestrial influence on the global atmospheric electrical circuit. The measurements show variations associated with solar flares, solar magnetic sector boundary crossings, geomagnetic activity, aurorae, differences between ground current and potential gradients at high and low latitudes, and solar cycle variations. The evidence for each variation is examined. Both the experimental evidence and the calculations made with a global model of atmospheric electricity indicate that there is solar-terrestrial coupling through atmospheric electricity which operates by altering the global electric current and field distribution. A global redistribution of currents and fields can be caused by large-scale changes in electrical conductivity, by alteration of the columnar resistance between thunderstorm cloud tops and the ionosphere, or by both. If the columnar resistance is altered above thunderstorms, more current will flow in the global circuit, changing the ionospheric potential and basic circuit variables such as current density and electric fields. The observed variations of currents and fields during solar-induced disturbances are generally less than 50% of mean values near the earth's surface. A.R.H.

N79-25614*# Miami Univ., Fla. Div. of Meteorology and Physical Oceanography.
TROPOSPHERIC EFFECTS ON THE MIDDLE ATMOSPHERE AND VICE-VERSA
Marvin A. Geller *In* NASA. Goddard Space Flight Center Middle Atmosphere Electrodyn. Jun. 1979 p 141-156 refs (For primary document see N79-25608 16-46)
Avail: NTIS HC A12/MF A01 CSCL 04A

The mechanisms by which phenomena occurring in the troposphere can affect that atmospheric region lying above the tropopause and below the mesopause are discussed as well as mechanisms by which middle atmospheric phenomena affect the tropospheric circulation, and how the middle atmosphere may act as a medium by which extraterrestrial effects may give rise to changes in tropospheric circulation. Energetics and external energy sources are considered. Aspects of vertical coupling examined include upward, downward, radiational, chemical, and electrical modes. A.R.H.

N79-25615*# State Univ. of New York at Albany. Atmospheric Sciences Research Center.
TROPOSPHERIC ELECTRIFICATION
Bernard Vonnegut *In* NASA. Goddard Space Flight Center Middle Atmosphere Electrodyn. Jun. 1979 p 157-168 refs (For primary document see N79-25608 16-46)

Avail: NTIS HC A12/MF A01 CSCL 04A

The solid Earth carried a negative charge of approximately 10C to the 6 th power and the lower atmosphere an equal, opposite charge. While a number of charging processes in the lower atmosphere are involved, such as erupting volcanoes, snow, sand and dust storms, and the bubbles bursting from the oceans, the primary cause of the Earth's electrification is activity of thunderstorms. Although it is known that the electrification of these clouds is caused by the accumulation of regions of charged water particles, there is no general agreement concerning which process is the cause of the electrification within the cloud and what role this electrification plays in the meteorological processes that take place in the lower atmosphere. The development of thunderclouds and the electric fields and currents above them are discussed. A.R.H.

N79-25616*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ENERGY AND MASS TRANSPORT IN THE THERMOSPHERE

H. G. Mayr, I. Harris, and N. W. Spencer *In its* Middle Atmosphere Electrodyn. Jun. 1979 p 169-202 refs (For primary document see N79-25608 16-46)

Avail: NTIS HC A12/MF A01 CSCL 04A

Examples illustrating the effects of large scale energy and mass transport in the thermosphere discussed include: (1) The seasonal variations reveal temperature, composition, and ionospheric anomalies involving energy exchange between the thermosphere and mesosphere. (2) The midnight temperature maximum in the thermosphere is interpreted as a signature of tidal waves emanating from the mesosphere and momentum coupling associated with ion drag. (3) The ionospheric storm in the F region illustrates the intricate effects of large scale atmospheric winds driven by magnetospheric energization processes. (4) Atmospheric signatures of Joule heating and electric field momentum coupling are markedly different. S.E.S.

N79-25617*# Communications Research Centre, Ottawa (Ontario).

ELECTRIC GENERATORS IN THE MAGNETOSPHERE-IONOSPHERE SYSTEM

G. Akinson *In* NASA. Goddard Space Flight Center Middle Atmosphere Electrodyn. Jun. 1979 p 203-217 refs (For primary document see N79-25608 16-46)

Avail: NTIS HC A12/MF A01 CSCL 04A

The nature and cause of electric fields in the coupled magnetosphere-ionosphere system and their effects in the middle atmosphere are discussed. Electric fields induced by the solar wind are reported. The equivalence between forces and electric currents and also between current closure and stress balance is described. The motions of the magnetospheric and ionospheric fluids and the electric fields of interest were determined by the balance of these forces, or equivalently by the closure of the currents. The physical nature of stresses and currents was examined. S.E.S.

N79-25618*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

AREAS WHERE SOLAR-TERRESTRIAL COUPLING MAY INFLUENCE OR BE INFLUENCED BY THE MIDDLE ATMOSPHERE

Richard A. Goldberg *In its* Middle Atmosphere Electrodyn. Jun. 1979 p 219-249 refs (For primary document see N79-25608 16-46)

Avail: NTIS HC A12/MF A01 CSCL 04A

The nature of the wave interactions, particularly those induced by transient solar and geomagnetic phenomena is discussed. Solar activity which includes modulations of galactic cosmic ray flux reaching Earth is discussed. Coupling processes involving charged particles and atmospheric electric structure are presented. S.E.S.

N79-25619*# Maryland Univ., College Park. Inst. for Physical Science and Technology.

LIDAR TEMPERATURE PROFILING: PERFORMANCE SIMULATIONS OF MASONS METHOD Final Report

Geary K. Schwemmer and Thomas D. Wilkerson [1979] 10 p refs

(Grant NsG-5174)

(NASA-CR-158697) Avail: NTIS HC A02/MF A01 CSCL 04A

Several methods of using lasers to measure atmospheric temperature profiles were described. Mason's suggestion was analyzed here to assess its capabilities for various lidar configurations. Temperatures were inferred from a measure of the Boltzmann distribution of rotational states in one of the vibrational bands of O2. Differential absorption was measured using three tunable, narrowband pulsed lasers. The outputs of two were tuned to wavelengths at the centers of absorption lines at either end of a particular branch in the band. The third wave-length was in a region of no absorption; its lidar return measured only the atmospheric backscatter, and therefore allowed calculations of the absorption coefficients at the other two wavelengths as a function of altitude. From the ratio of the two line absorption coefficients plus a priori knowledge of the line parameters, the temperature-altitude profile were calculated. J.A.M.

N79-25620# Istituto di Metrologia G. Colonetti, Torino (Italy).

ABSOLUTE GRAVITY MEASUREMENTS IN THE UNITED STATES OF AMERICA Final Report, 5 Dec. 1977

Iginio Marson (Trieste Univ., Italy) and Franco Alasia May 1978 82 p refs

(Grant AF-AFOSR-3529-78)

(AD-A057136; R-124) Avail: NTIS HC A05/MF A01 CSCL 04/2

The measurements of gravity acceleration described were performed in 1977. The introductory part of the report illustrates the transportable absolute gravimeter and ancillary instrumentation used in measurements, and describes the measurement method applied; uncertainty and errors are analyzed as well. Measurements of gravity acceleration made in Europe prior to the U.S.A. program are also briefly considered. Author

N79-25621# Liege Univ., Cointe-Ougree (Belgium). Inst. of Astrophysics

HIGH RESOLUTION TRANSMISSION MEASUREMENTS OF THE ATMOSPHERE IN THE INFRARED Interim Scientific Report, 1 Mar. 1977 - 28 Feb. 1978

Marcel V. Migeotte, R. Zander, and L. Delbouille 28 Apr. 1978 39 p refs

(Grant AF-AFOSR-2985-76)

(AD-A056519; AFGL-TR-78-0165) Avail: NTIS HC A03/MF A01 CSCL 04/1

A summary of infrared solar observations from the ground, obtained in 1977 is given. The scientific efforts which were devoted to the analysis of these observations, in order to deduce new informations on both the solar and the telluric atmospheres are mentioned. In relation to the problem of the pollution of the stratosphere, the observations allowed conclusions on the usefulness of ground monitorings for species such as HF and HCl. G.Y.

N79-25622*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

PROBLEMS IN MODELING THE EARTH'S TRAPPED RADIATION ENVIRONMENT Interim Report, 1 Oct. 1977 - 30 Sep. 1978

James I. Vette, King W. Han, and Michael Teague Hanscom AFB, Mass. AFGL Dec. 1977 33 p refs

(NASA-TM-80447; AD-A059273; AFGL-TR-78-0130) Avail: NTIS HC A03/MF A01 CSCL 04A

The status of present trapped radiation models was reviewed. Problems regarding energy, spatial, and temporal coverage were discussed in detail. Suggestions were given as to which type of measurements were most needed for model improvements. Author

N79-25623# Naval Research Lab., Washington, D. C.

UPPER ATMOSPHERIC EXCITATION PROCESSES Interim Report

A. W. Ali, R. H. Kummler, Forest R. Gilmore, and William J. McGowan 27 Feb. 1979 128 p refs

(AD-A067330; AD-E000284; NRL-MR-3920) Avail: NTIS HC A07/MF A01 CSCL 04/1

A review of the excitation and deexcitation processes relevant

to the disturbed and the quiescent upper atmosphere is presented along with the current reaction rate coefficients. GRA

N79-25624# Weather Wing (1st), Hickam AFB, Hawaii.
THE ROLE OF ATMOSPHERIC TIDAL WINDS IN THE PRODUCTION OF IONOSPHERIC SPORADIC-E Final Report, 1 Jul. 1975 - 30 Jun. 1977
Bruce D. Springer 30 Jun. 1978 114 p refs
(AD-A066839; Rept-1WW-TN-78-1) Avail: NTIS HC A06/MF A01 CSCL 04/2

This report summarizes an investigation of the interactions among atmospheric tidal winds, the earth's magnetic field, and metallic ions in the upper atmosphere (90-180 km). The results support the theory that upper atmospheric tidal winds play a critical role in the formation of ionospheric sporadic-E. The contributions of various tidal wind modes are analyzed through the use of extensive computer simulations. Author (GRA)

N79-25625# Texas Instruments, Inc., Dallas. Equipment Group.
SHORT-PERIOD NOISE ENVELOPE STATISTICS: A BASIS FOR ENVELOPE DETECTOR DESIGN
Rudolf Unger 26 Sep. 1978 78 p refs
(Contract F08606-77-C-0004; ARPA Order 2551)
(AD-A066713; TI-ALEX(01)-TR-78-05; TR-17) Avail: NTIS HC A05/MF A01 CSCL 17/10

This report focuses on the use of certain detection statistics, in particular the instantaneous amplitude or envelope, and the instantaneous power, in the design of a controlled false alarm rate detector. To achieve false alarm rate control, the detection statistic must be stationary, but need not be Gaussian. Parameters of a Gaussian process can be conveniently transformed into a stationary, normalized detection statistic. For an envelope detector the normalization consists of dividing the envelope by a long-term (1 to 2 minutes) estimate of the RMS noise level; the instantaneous power is normalized by dividing it by the long-term average power. The stationarity of the normalized envelope is demonstrated with one hour of uninterrupted, Korean Seismic Research Station single-site, short-period noise, by compiling distributions of the base-ten logarithm of the normalized envelope. The envelopes closely follow the Rayleigh distribution which is the theoretical distribution for envelopes of a Gaussian process. Retaining this model at the 5% significance level establishes adequate control of the false alarm rate. GRA

N79-25626# Texas Instruments, Inc., Dallas. Equipment Group.
DETECTION PERFORMANCE OF TIME-VARYING ADAPTATION RATE ADAPTIVE BEAMFORMER
Wen-Wu Shen 15 Sep. 1978 180 p refs
(Contract F08606-77-C-0004; ARPA Order 2551)
(AD-A066714; TI-ALEX(01)-TR-78-06; TR-18) Avail: NTIS HC A09/MF A01 CSCL 17/10

The previously developed time-varying adaptation rate adaptive beamformer (ABF) was modified for the purpose of using a fixed set of design parameters in different levels of noise and signals. The ABF performance was evaluated in terms of its capability to suppress seismic coda wavetrains of strong earthquakes, accuracy of its bodywave magnitude (m sub b) measurements and detection capability, as compared with those of single sites and the conventional beamsteer using recorded data from the Korean Seismic Research Station (KSRS) short-period array. A total of 129 events recorded in winter were processed. On the average, the ABF yielded the same magnitude difference (0.1 m sub b units smaller) as the beamsteer, when compared with the NEIS and NORSAR bulletin mb. However, preliminary results indicated that the ABF may have improved the array detection capability by 0.5 mb units from the conventional beamsteer based on subjective analyst interpretation of the detection status of processed events. More data with automatic detection criteria applied are needed to more accurately estimate the detection gains which are possible by applying the ABF as a field operating front-end detector.
Author (GRA)

N79-25627# Texas Instruments, Inc., Dallas. Equipment Group.
FEASIBILITY STUDY OF MIXED-SIGNAL SEPARATION TECHNIQUES
Wen-Wu Shen 12 Jul. 1978 61 p refs
(Contract F08606-77-C-0004; ARPA Order 2551)
(AD-A066715; TI-ALEX(01)-TR-78-07; TR-9) Avail: NTIS HC A04/MF A01 CSCL 17/10

A fesibility study to enhance a weaker signal hidden in the stronger wavetrains of different seismic sources was conducted. Two array beamforming methods were developed for and applied to the mixed-signal problem: one is the adaptive beamformer (ABF) and the other is array shading technique. The ABF operates in the time domain, requires no a priori information, and can be used for a front-end detector. The array shading technique is designed in the frequency domain, needs interfering azimuth for null steering, and is intended for a post-detection processor. Results from experimental tests with recorded data from the Korean Seismic Research Station short-period array are also included. Author (GRA)

N79-25628# Texas Instruments, Inc., Dallas. Equipment Group.
EXTRACTION OF SEISMIC WAVEFORMS
Alan C. Strauss 29 Sep. 1978 75 p refs
(Contract F08606-77-C-0004; ARPA Order 2551)
(AD-A066711; TI-ALEX(01)-TR-78-02; TR-14) Avail: NTIS HC A04/MF A01 CSCL 17/10

This report considers the effects on detectability and measurability resulting from attempts to extract seismic waveforms by application of cascaded processors and polarization filters. Previous work has shown that bandpass or Wiener filters (when cascaded with the three-component surface wave adaptive processor) caused improvements of as much as 0.8 m sub b units in the 50 percent detection threshold of surface waves. This report shows that by using a larger data base, this improvement in the detection threshold is 0.5 units. It is also shown in this report that surface wave magnitudes measured on data processed by the bandpass filter-three-component surface wave adaptive processor cascaded combination compare well with surface wave magnitudes measured on bandpass filtered data, however, surface wave magnitudes measured on data processed by the Wiener filter-three-component surface wave adaptive processor do not. GRA

N79-25629# Texas Instruments, Inc., Dallas. Equipment Group.
APPLICATION OF RINGDAL'S METHOD TO UNBIASED MEASUREMENT OF THE Ms-mb RELATIONSHIP
Alan C. Strauss 31 Aug. 1978 50 p refs
(Contract F08606-77-C-0004; ARPA Order 2551)
(AD-A066712; TI-ALEX(01)-TR-78-03; TR-15) Avail: NTIS HC A03/MF A01 CSCL 17/10

Ringdal's maximum likelihood method of removing magnitude bias was tested by removing the apparent bias of surface wave magnitude estimates. Bias removal was convincingly demonstrated by comparing maximum likelihood estimates of M sub s obtained by a single sensor to those obtained by an array at the Alaskan Long Period Array (ALPA) site. Since the beamformed array has a lower detection threshold than the single-sensor reference site, it can serve as the standard by which to judge whether positive magnitude bias has been removed from the reference site surface wave magnitude estimates. The results of this test indicate that below the 90 percent detection threshold of the reference site, positive magnitude bias becomes a significant factor in surface wave magnitude estimates. Comparison with beamformed array data indicates that application of Ringdal's method accurately removes this bias down to approximately the reference site 25 percent detection threshold. Below this point, the method over-corrects the magnitude estimates, resulting in abnormally low values. GRA

N79-25630# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
A THEORETICAL INVESTIGATION OF CLOUD/FOG OPTICAL PROPERTIES AND THEIR SPECTRA CORRELATIONS Research and Development Technical Report
Richard D. H. Low Feb. 1979 35 p refs
(DA Proj. 1L1-62111-AH-71)
(AD-A066539; ERADCOM/ASL-TR-0024) Avail: NTIS HC A03/MF A01 CSCL 04/1

The primary objective of the Electro-Optical Systems Atmospheric Effects Library (EO SAEL) is to provide the Army with an extensive collection of well-conceived and well-documented atmospheric models which can be used with confidence in predicting atmospheric effects on the performances of a variety of electrooptical weapons and communications systems either in computer simulation or under battlefield conditions. One of the models considered is the well-known relationship between visibility (or extinction) and the liquid water content of a cloud (or fog). However, evidence exists that it varies from one cloud (or fog) to another with different slopes. This paper reexamines this relationships and its ramifications. In the case of unimodal or quasi-unimodal drop-size spectra, as can be well-represented by the gamma or the lognormal distribution: (1) visible extinction appears to correlate well with liquid water content and with infrared extinction, except when the drop-size spectra and relatively narrow; (2) the consistency of observed microphysical and spectral measurements may be judged by the degree of agreement with the regression lines of the models; (3) by simply increasing or decreasing the liquid water content (or alternately, droplet number concentration), a corresponding change in optical property may be effected without regard to spectral shapes; and (4) sampling errors would cause a much greater error in the calculation of extinction coefficients when large droplets are missing than when small droplets are. GRA

N79-25631# Weapons Systems Research Lab., Adelaide (Australia).
UPPER ATMOSPHERE RESEARCH AT WRE: A REVIEW Technical Report, 1960-1976
K. H. Lloyd May 1978 61 p refs
(AD-A066537; WSRL-0012-TR) Avail: NTIS HC A04/MF A01 CSCL 04/1

Upper atmosphere research using sounding rockets was supported at Weapons Research Establishment by the Australian Government from 1960 until 1976. This paper reviews the upper atmosphere project as it was carried out by the three Groups involved. The rocket vehicles are described, together with the experiments carried in them including details of the techniques used. The most significant scientific discoveries obtained from the data are presented and discussed. Author (GRA)

N79-25632# Naval Postgraduate School, Monterey, Calif.
PROCEDURE FOR STATISTICAL ANALYSIS OF SINGLE SCAN MODULATION TRANSFER FUNCTIONS FOR OPTICAL TRANSMISSION IN THE MARINE BOUNDARY ATMOSPHERE M.S. Thesis
Rolf A. Molland Dec. 1978 127 p refs
(AD-A066396) Avail: NTIS HC A07/MF A01 CSCL 04/1

A computer data reduction system has been reprogrammed to sample individual scan recordings of the line-spread function of laser light propagating through the turbulent marine boundary layer. The distribution of spatial frequencies of the Modulation Transfer Functions from random single scan samples from experimental data sets has been investigated. A preliminary analysis indicates that the zero spatial frequency component of the MTF is log-normal distributed. Author (GRA)

N79-25633# Naval Postgraduate School, Monterey, Calif.
HIGH RESOLUTION COMPUTER CALCULATION OF OPTICAL TRANSMITTANCE AT SEA LEVEL OVER MONTEREY M.S. Thesis
Nusret Guner Dec. 1978 112 p refs
(AD-A066360) Avail: NTIS HC A07/MF A01 CSCL 04/1

Computer programs have been developed for calculation of the molecular absorption and aerosol extinction for horizontal path propagation of radiation in the wavelength range above 0.55 micrometers. The AFCRL line parameters compilation is used as input data with local weather conditions for the Monterey Bay and model of typical aerosol size distribution from Shettle and Fenn. Wind speed and relative humidity are included in the form developed by Wells, Gal and Munn. Infinite resolution computations have been carried out for 1.06, 3.8 and 10.6 micrometers and results tabulated for monthly and yearly average weather conditions on Monterey Bay. Bandwidth-averaged spectral transmittances have been calculated at 0.01 cm-1 and 0.5 cm-1 resolution for the same conditions. Comparisons with previously published data show agreement to 1.8% with maritime model aerosol Mie-scattering calculations by Selby using LOWTRAN III B. Analysis of sensitvity to changes of pressure and temperature for the 3.8 micrometers range showed only small effects of these parameters. However a change in water vapor partial pressure results in a 0.75% /mbar change in transmittance in the 3.8 micrometers region. Author (GRA)

N79-25634# Computer Corp. of America, Cambridge, Mass.
REPORT ON THE IMPLEMENTATION AND TEST OF SWF-D: THE SIGNAL WAVEFORM FILE DEMON
Joanne Z. Sattley Jan. 1979 157 p refs
(Contract N00039-78-C-0246; ARPA Order 3540)
(AD-A066137; CCA-79-09) Avail: NTIS HC A08/MF A01 CSCL 17/10

For a number of years, the Nuclear Monitoring Research Office (NMRO) has sponsored the development of tools and techniques which have been of value in advancing seismological research. But only with the development of large-database techniques has it been possible for seismologists to do meaningful analytical work over the vast quantities of data which represent seismic activity. Instruments, installed world-wide, detect, acquire and measure seismic readings. And computers are employed in virtually every aspect of collecting, analyzing, processing and storing seismic waveform data. At CCA, the Data computer (MARILL and STERN) was developed under ARPA funding to function as a first-of-a-kind network data utility for the support of very large databases, allowing shared remote access by heterogeneous computers in a network environment. The Datacomputer thus provides the facility required to store online the very large amounts of seismic data being collected. GRA

N79-25635# Ohio State Univ., Columbus. Dept. of Geodetic Science.
STUDIES OF THE EARTH'S GRAVITY FOR GEODETIC PURPOSES Final Report, 1 Jul. 1975 - 30 Sep. 1978
Urho A. Uotila and Richard H. Rapp Dec. 1978 36 p refs
(Contract F19628-76-C-0010; AF Proj. 7600)
(AD-A064531; DGS-279; AFGL-TR-78-0301) Avail: NTIS HC A03/MF A01 CSCL 08/5

This report summarizes the work carried out from 1 July 1975 to September 1978 on an AFGL project directed towards the study of the earth's gravity field. Each report is described and put in context with the total research effort. The main areas described in the report relate to the theory and application of least squares collocation; the theory and development of covariance functions; the theory and results from using airborne gradiometry; and the use of satellite to satellite tracking data for the recovery of anomalies on the surface of the earth. Author (GRA)

N79-25636# Naval Research Lab., Washington, D. C.
ROTATIONAL DEFORMATION OF THE EARTH AND MAJOR PLANETS Final Report
Paolo Lanzano and John C. Daley 18 Aug. 1978 28 p refs
(AD-A060900; NRL-8252) Avail: NTIS HC A03/MF A01 CSCL 08/7

Recently developed third-order theory of hydrostatic equilibrium to study the deformations which the Earth, Jupiter, and Saturn undergo because of their rotational motion were applied. For the Earth, input the Bullen, HB1, 1066A, and QM2 density models to solve the Clairaut equation numerically and compare the results with data obtained from sate:::.es. A linearized version of the Navier-Stokes equation is next developed to take into account the elastic characteristics of the Earth and to model the shear stresses and convection currents existing in the Earth's upper layers. The numerical solution of this last equation, however, is left for future reporting. For Jupiter and Saturn, use the DeMarcus density profile in conjunction with the Brouwer and Clemence data and compare results with an older attempt and some recent work based on a different density profile and a less sophisticated equilibrium theory. The third-order theory leads to the Clairaut equation with boundary conditions and is amenable to a rapid and accurate numerical solution. Method appears to be an improvement to the present state of the art in planetology. This avoids the use of complicated systems of integral equations that are difficult to solve numerically. GRA

N79-25637# Air Force Geophysics Lab., Hanscom AFB, Mass.
MODELING OF THE GEOSYNCHRONOUS ORBIT PLASMA ENVIRONMENT. PART 2: ATS-5 AND ATS-6 STATISTICAL ATLAS
Henry B. Garrett, E. G. Mullen, E. Ziemba, and S. E. DeForest 30 Nov. 1978 35 p refs
(AF Proj. 7661)
(AD-A067018; AFGL-TR-78-0304-Pt-2; AFGL-ERP-648-Pt-2) Avail: NTIS HC A03/MF A01 CSCL 04/1

A preliminary statistical analysis of the ATS-5 and ATS-6 geosynchronous plasma data has been carried out. Variations in the electron and ion currents and temperatures, as represented by the single Maxwellian component temperatures T(AVG) and T(RMS), are evaluated with respect to local time and geomagnetic activity. The potential on the satellites is similarly evaluated. Results indicate that the geosynchronous plasma cannot be adequately represented by a simple Maxwellian distribution and that, at the very least, a two component Maxwellian is necessary. The electron current and eclipse potential were found to vary strongly with K sub p while the temperatures only varied weakly. Local time variations in temperature and current were observed but these were outweighted by a significant local time variation in satellite potential which peaked near midnight. An explanation of these results is proposed in terms of a simple model of the time evolution of the plasma following an injection. Author (GRA)

N79-25638# Saint Louis Univ., Mo. Dept. of Earth and Atmospheric Sciences.
COMPUTER PROGRAMS IN EARTHQUAKE SEISMOLOGY. VOLUME 1: GENERAL PROGRAMS
Robert B. Herrmann Nov. 1978 226 p refs 2 Vol.
(Grant NSF ENV-78-20875)
(PB-292462/9; NSF/RA-780517-Vol-1) Avail: NTIS HC A11/MF A01 CSCL 08K

Eleven documented copies of computer programs on spectral analysis and general purpose routines for use in earthquake seismology are presented and described. Presently operating on a Honeywell 6023 Computer, the programs are free of machine dependent peculiarities with a few exceptions which are noted. Although most programs require an offline CALCOMP drum plotter, in more recent programs plotting calls are performed in modular subroutine units to facilitate conversion to other plotting systems. The CALCOMP subroutines are listed. GRA

N79-25639# Saint Louis Univ., Mo. Dept. of Earth and Atmospheric Sciences.
COMPUTER PROGRAMS IN EARTHQUAKE SEISMOLOGY. VOLUME 2: SURFACE WAVE PROGRAM
Robert B. Herrmann Nov. 1978 235 p refs 2 Vol.
(Grant NSF ENV-78-20875)
(PB-292463/7; NSF/RA-750518-Vol-2) Avail: NTIS HC A11/MF A01 CSCL 08K

Twelve documented copies of computer programs dealing with surface wave propagation in a plane layered medium, to be used in earthquake seismology are presented and described. The programs were designed so that the output of one is compatible with the input of another program. These programs are presently operating on a Honeywell 6023 and are free of machine dependent peculiarities, with a few exceptions listed in the introduction. Although most programs require an offline CALCOMP drum plotter, in more recent programs plotting calls are performed in modular subroutine units to facilitate conversion to other plotting systems. The CALCOMP subroutines are listed. GRA

N79-25640# National Oceanic and Atmospheric Administration, Boulder, Colo. Space Environment Lab.
RING CURRENT COMPOSITION AND SOURCES
D. J. Williams Oct. 1978 32 p refs
(PB-293583/1; NOAA-TM-ERL-SEL-52; NOAA-79030708) Avail: NTIS HC A03/MF A01 CSCL 04A

Direct composition observations exist only in the low (less than, or about equal to 15 keV) and high (more than, or about equal to 1 MeV) energy tails of the ring current energy density distribution. It is shown that significant acceleration beyond that provided by the source is required to establish the storm time ring current irrespective of the source considered. The results of direct observations and inference techniques concerned with ring current composition through the energy range from about 0.5 keV to several MeV are summarized. Possible sources and ring current development are discussed. GRA

N79-25641# Oklahoma Univ., Norman. School of Meteorology.
ANALYSIS OF ENSEMBLE AVERAGE CONCENTRATIONS AND FLUXES IN A TRACER PUFF Final Report
Main R. Hutcheson Jan. 1979 113 p refs
(Grant EPA-804507)
(PB-292489/2; EPA-600/4-79-002) Avail: NTIS HC A06/MF A01 CSCL 04A

Ensemble averaged fluxes and concentrations in a tracer puff diffusing in the atmospheric surface layer were analyzed. Fluxes that satisfy the diffusion equation for a Gaussian puff with an arbitrary diffusion rate were obtained from the gradient transfer hypothesis, using the proper diffusivities. These fluxes were used as estimates of the ensemble averaged fluxes in the surface layer. The radiation data, however, were too sparse to use alone in analyzing the tracer concentrations. Therefore, the data were combined with a modified Gaussian distribution in a variational technique to obtain concentration values. Since the ensemble averaged concentration distribution was more nearly normal than the distribution in an individual puff, the concentration estimates were obtained from a model using a Gaussian distribution in the horizontal. GRA

N79-25642# Pennsylvania State Univ., University Park. Dept. of Geosciences.
CARBONATE HYDROGEOLOGIC ENVIRONMENTS: THEIR RELATIONSHIP TO LAND USE, WATER RESOURCES DEVELOPMENT AND MANAGEMENT
Richard R. Parizek Feb. 1979 90 p
(Contract DI-14-34-0001-8040)
(PB-292337/3; W79-04494; OWRT-A-005-PA(8)) Avail: NTIS HC A05/MF A01 CSCL 13B

The interrelationship between surface water and groundwater was investigated and the chemical quality of groundwater for a terrain underlain by nearly 8,000 feet of folded and faulted carbonate rocks was examined. Further, the influences of drought, urbanization, industrialization and recreation related to the physical environment's response to these stresses were investigated. Solid and liquid waste disposal practices were of special concern and attempts were made to define the waste management site selection criteria required to protect important groundwater supplies from threats of pollution. Use of fracture traces to locate highly productive water wells is now in wide use in Pennsylvania and elsewhere in the United States, and it is no longer restricted to carbonate rocks. GRA

N79-25643# Pennsylvania State Univ., University Park. Dept. of Meteorology.
STUDIES IN ESTIMATING THE ELEMENTS OF RADIATION BALANCE. 1: ALBEDO OVER LAND. 2: LONG AND SHORT WAVE RADIATION OVER OCEANS, A PILOT STUDY
John J. Cahir, Hans A. Panofsky, David Linder, and Charles Burger 1978 73 p refs
(Grant NOAA-04-6-158-44013)
(PB-293723/3; NOAA-79013101) Avail: NTIS HC A04/MF A01 CSCL 04A

Relations between albedo measured on summer mornings over the United States and predictions from a numerical model were developed using seven months of daily data. The predictions are mean relative humidity between 1000 and 500 mb, 850 mb height, 500 mb vorticity, and the southerly wind component at 200 mb. This result was compared with previous work to see if a set of predictors for morning albedo that would be valid throughout the year could be obtained. Finally, a pilot study was performed on the problem of estimating the infrared and visible radiation at the top of the atmosphere over the oceans during winter. GRA

N79-25644# National Geodetic Survey, Rockville, Md.
THE APPLICATION OF MULTIQUADRIC EQUATIONS AND POINT MASS ANOMALY MODELS TO CRUSTAL MOVEMENT

Rolland L. Hardy Nov. 1978 63 p refs
(PB-293544/3; NOAA-TR-NOS-76; NGS-11;
NOAA-79022804) Avail: NTIS HC A04/MF A01 CSCL 08G

The basic theory of multiquadric (MQ) equations relevant to crustal movement studies is summarized. Both the hyperboloid and reciprocal hyperboloid kernels of an MQ function are given a point mass anomaly interpretation. They are applied to a realistic error-free model of subsidence in the Houston-Galveston area, in a pure prediction test. The standard error of a single prediction was found to be less than 0.5 cm/yr for optimum depths of point mass anomalies, using either the hyperboloid or reciprocal hyperboloid as kernels. The rectangular study area of about 88 by 124 km included 49 error-free sample points in an irregular pattern, and 49 error-free prediction points in a grid pattern. Subsidence rates in the area ranged from about -1 cm/yr to -9 cm/yr. Only subsidence information provided by geodetic leveling (simulated) was used. GRA

N79-25645# Colorado Univ., Boulder. Inst. of Arctic and Alpine Research.
WORLD DATA CENTER A FOR GLACIOLOGY (SNOW AND ICE) NEW ACCESSIONS LIST NO. 1
Dec. 1978 49 p Sponsored by NOAA
(PB-293521/1; NOAA-79022712) Avail: NTIS
HC A03/MF A01 CSCL 08L

The first quarterly list of documents acquired by the Data Center during the period June-August 1978 is presented. It was generated from the new computerized bibliographic data system. Books, technical reports, conference proceedings, and reprints are included; most journal articles have not yet been indexed. The subject headings are those used by the U.S. Cold Regions Research and Engineering Laboratory in their Bibliography on Cold Regions Sciences and Technology. Bibliographic items are repeated in their entirety under each appropriate subject heading. GRA

N79-25646# Geological Survey, Menlo Park, Calif.
APPLICATION OF STRESS-STRAIN RELATIONS IN EQUIVALENT-LINEAR GROUND-MOTION ANALYSES Final Report
Albert T. F. Chen Jan. 1979 24 p refs
(PB-292399/3; USGS/GD-79/001) Avail: NTIS
HC A02/MF A01 CSCL 08M

The sensitivity of seismic ground response computations using the equivalent-linear analysis to the choice of stress-strain relations for the soil was investigated. Although the results from a given example seem to imply the difference in the computed surface response resulting from using these relations to be insignificant, further analysis show that the frequency response of the site varies significantly with the type of stress-strain relation chosen as well as with the intensity of the input base motion. The cause and the implication of such a difference in frequency response was fully discussed. GRA

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N79-25647 British Library Lending Div., Boston Spa (England).
A NUMERICAL MODEL OF GLOBAL TRANSPORT OF FREONS IN THE ATMOSPHERE, AND ESTIMATES OF THEIR EFFECT ON STRATOSPHERIC OZONE
I. L. Karol and A. A. Kiselev 13 Mar. 1979 21 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 394, 1977 p 44-55
(BLL-Trans-1399-(9022.549)) Avail: NTIS Avail: British Library Lending Div., Boston Spa, Engl.

In the problem of the atmospheric propagation of chlorofluoromethanes (freons) and of their effect on stretospheric ozone (4, 5, 9), particular importance was attached to accurate estimation of the nature and rate of atmospheric transport of these gases from their surface sources into the middle stratosphere and also of the rate of their photodissociation in this layer under the influence of ultraviolet radiation from the sun. Correct estimation of the rates of these processes enabled a determination of the growth in concentration of chlorine and its compounds in the stratosphere and of the degree of their expected catalytic decomposition by ozone molecules in the coming years and decades. J.A.M.

N79-25648 British Library Lending Div., Boston Spa (England).
COMPUTING THE FRACTION OF PRECIPITATION EVAPORATING DIRECTLY FROM THE GROUND AND FROM PLANTS
V. G. Andreyanov 14 Nov. 1978 12 p refs Transl. into ENGLISH from Gosudarst Gidr. Inst. (Leningrad), v. 241, 1977 p 76-87
(BLL-Trans-1379-(9022.549)) Avail: British Library Lending Div., Boston Spa, Engl.

Accounting for the fraction of precipitation evaporated from the soil and vegetation made it possible to isolate the surface zone in the proposed physico-mathematical model of the water balance of a river basin. The application of the model greatly simplifies the analysis and coordination of water balances and consolidates the reliability and accuracy of water balance computations. G.Y.

N79-25649 British Library Lending Div., Boston Spa (England).
METROLOGICAL EXAMINATION OF METEOROLOGICAL LIQUID THERMOMETERS
L. I. Leonova and T. P. Domankova 14 Nov. 1978 13 p refs Transl. from Tr. Gl. Geofiz. Observ. (Leningrad), no. 392, 1977 p 47-53
(BLL-Trans-1374-(9022.549)) Avail: British Library Lending Div., Boston Spa, Engl.

Work was done from 1974 to 1975 on testing production models of the following types of meteorological thermometers: psychrometric thermometers, earth thermometers, soil thermometers, mercury barometers, sling psychrometers, jointed Savinov thermometers, maximum and minimum thermometers, and low temperature spirit thermometers. The research program included testing of the thermometers for compliance with requirements of the A11 Union State Standards. The work led to the determination of the error in thermometer readings at all scale points divisible by 10, for test conditions after the exclusion of systematic errors. A procedure entitled, Meteorological Mercury and Spirit Thermometers - Methods and Means of Testing, was developed. G.Y.

N79-25650 British Library Lending Div., Boston Spa (England).
ATMOSPHERIC FRONTS AND INTERTROPICAL CONVERGENCE ZONES ON CHARTS OF RADIATION TEMPERATURES
P. N. Belov, Yu. V. Kurilova, and G. L. Slepenkova 6 Nov. 1978 12 p refs Transl. into ENGLISH from Gidromet. Nauch-Issled. Tsent. USSR (Leningrad), v. 50, 1969 p 54-59 In ENGLISH and RUSSIAN
(BLL-Trans-1372-(9022.549)) Avail: British Library Lending Div., Boston Spa, Engl.

Results of research designed to obtain the quantitative characteristics of the radiation fields of fronts and ITCZ's are presented. The data used were radiation temperatures in the 8-12 microns band. G.Y.

N79-25651 British Library Lending Div., Boston Spa (England).
METROLOGICAL EXAMINATION OF STANDARD MERCURY MANOMETERS AND BAROMETERS
N. P. Fateyev, L. J. Leonova, and M. A. Andreyev 6 Nov. 1978 13 p refs Transl. into ENGLLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 392, 1977 p 29-35
(BLL-Trans-1373-(9022.549)) Avail: British Library Lending Div., Boston Spa, Engl.

A method for testing the limits of allowable error throughout the entire range of measurement is presented. The results of experimental findings for these instruments are also presented. The errors in measurements of pressure were determined by direct comparison of the manometers and barometers with the readings of a standard heavy-piston manometer at atmospheric pressure and throughout the entire range of measurement. The standard manometer has a range of 2.7 to 1100 mb and an error of 0.05 mb. G.Y.

N79-25652# Schweizerische Meteorologische Zentralanstalt, Zurich.
PROCEEDINGS OF THE FIFTEENTH INTERNATIONAL MEETING ON ALPINE METEOROLOGY, VOLUME 2
1979 63 p refs In ENGLISH; partly in GERMAN and FRENCH Proc. held at Grindelwald, Switzerland, 19-23 Sep. 1978 (ISSN-0080-7346; Rept-41) Avail: NTIS HC A04/MF A01

This second part of the conference proceedings contains 8 papers, 3 presentations of posters, and a summary of the 52 climatological reports. Topics covered include solar radiation science, wind, precipitation, theoretical meteorology, and atmospherics physics. For individual titles, see N79-25653 through N79-25661.

N79-25653# Hydrometeorological Inst. of the Socialist Republic of Macedonia, Skopje (Yugoslavia).
EXCEPTIONALLY HEAVY PRECIPITATION IN THE REGION OF THE SOUTH PART OF ADRIATIC COAST WITH THE MAXIMUM ANNUAL PRECIPITATION IN EUROPE
Vitomir Dimitrievski *In* Schweizerischen Meteorologischen Zentralanstalt Proc. of the 15th Intern. Meeting on Alpine Meteorology, Vol. 2 1979 p 13-18 refs (For primary document see N79-25652 16-47)
Avail: NTIS HC A04/MF A01

Data from 10 years observation of precipitation in the mountainous area of the Orjen were analyzed. In this area, 131 days were registered with total values higher than 100 mm for 24 hours, from which in 25 cases they were higher than 200 mm for 24 hours. Some important parameters are given as well as statistical indicators which may be of interest for climatological, aerological and synoptical point of view. A.R.H.

N79-25654# Hydrometeorological Inst. of the Socialist Republic of Croatia, Zagreb (Yugoslavia).
CALCULATION ERRORS OF THE PRESSURE GRADIENT FORCE IN SIGMA COORDINATE SYSTEM TERRAIN [BERECHNUNGSFEHLER DER GRADIENTKRAFT IM SIGMA KOORDINATENSYSTEM IN ANNESENHEIT DER STEILEN GEBIRGE]
Bojan Lipovscak *In* Schweizerischen Meteorologischen Zentralanstalt Proc. of the 15th Intern. Meeting on Alpine Meteorology, Vol. 2 1979 p 19-21 refs In GERMAN; ENGLISH summary (For primary document see N79-25652 16-47)
Avail: NTIS HC A04/MF A01

Arakawa, Corby et al. and Janjic have developed the methods for calculating the pressure gradient force in sigma coordinate system which is particularly important in the case of steep topography. The methods are compared with the identical initial conditions. On the basis of Janjic's method a new choice of the interpolation function for geopotential as derived and tested in the procedure of numerical weather forecasting incorporating steep topography in the prediction model. Author

N79-25655# SEDE S.A., Vevey (Switzerland).
WIND AND TURBULENCE MEASUREMENTS WITH HIGH RESOLUTION ANEMOMETERS ON TOWERS AND ON A TETHERED BALLOON
Pierre Lehmann *In* Schweizerischen Meteorologischen Zentralanstalt Proc. of the 15th Intern. Meeting on Alpine Meteorology, Vol. 2 1979 p 22-26 refs (For primary document see N79-25652 16-47)
Avail: NTIS HC A04/MF A01

As part of a general study of local climate in the Rhine Valley between Basel and Waldshut, high calculation wind measurements were carried out using instrumented meteo towers and a tethered balloon system. The results obtained from these two systems for mean wind, variances and eddy-diffusivity coefficient estimates are presented. An attempt was made to establish an eddy-diffusivity profile using the tethered balloon wind measuring equipment. Difficulties were encountered due to equipment-induced perturbations and also to sampling period requirements for turbulence parametrization. It appears however that usable results may be obtained if the measuring procedures are improved. A.R.H.

N79-25656# Ceskoslovenska Akademie Ved, Bratislava.
WIND STRUCTURE IN MOUNTAIN VALLEYS [ZUR WINDSTRUKTUR IN GEBIRGSTALERN]
Jan Otruba *In* Schweizerischen Meteorologischen Zentralanstalt Proc. of the 15th Intern. Meeting on Alpine Meteorology, Vol. 2 1979 p 27-30 refs In GERMAN; ENGLISH summary (For primary document see N79-25652 16-47)
Avail: NTIS HC A04/MF A01

The hourly enemographic records of wind speed and maximal wind gusts for the 1961-1970 period at the station Svermovo in the upper valley of the Hron river, in the Western Carpathians were analyzed. Results show that gustiness depends on circulation factors and orographic conditions. Local thermodynamical factors manifest themselves most in daily gustiness behavior. A.R.H.

N79-25657# Eidgenoessische Technische Hochschule, Zurich (Switzerland).
SIGNIFICANCE OF LOCAL CIRCULATION ALONG HILLY TERRAIN FOR OZONE DESTRUCTION NEAR GROUND [BEDEUTUNG DER LOKALZIRKULATION IN HUEGELIGEM GELAENDE FUER DIE BODENZERSTOERUNG DES OZONS]
Hans-Ulrich Duetsch, Werner Graber, and Benedikt Broder *In* Schweizerischen Meteorologischen Zentralanstalt Proc. of the 15th Intern. Meeting on Alpine Meteorology, Vol. 2 1979 p 31-33 refs In GERMAN; ENGLISH summary (For primary document see N79-25652 16-47)
Avail: NTIS HC A04/MF A01

The mean day-night ozone variation in fine weather situation is determined for the planetary boundary layer up to 1000 m above ground from quasi-continuous soundings with a tethered balloon using an electrochemical sonde. The night time ozone destruction is found to be considerably higher than normally quoted due to the local downhill circulation along the hills on either side of the observational site in Switzerland. A.R.H.

N79-25658# Schweizerische Meteorologische Zentralanstalt, Zurich.
LOCAL PERIODICAL WINDS AND THE VARIATIONS OF TEMPERATURE AND RELATIVE HUMIDITY OF THE AIR AT THE OPENINGS OF THE MOUNTAINOUS VALLEYS OF THE BISTRITA RIVER, EASTERN CARPATIANS [LES VENTS PERIODIQUES LOCAUX ET LA VARIATION DE LA TEMPERATURE ET DE L'HUMIDITE RELATIVE DE L'AIR A L'EMBOUCHURE DE LA VALLEE MONTAGNEUSE DE LA RIVIERE BISTRITA, CARPATES ORIENTALES]
Ion-Florin Mihailescu (Station de Recherches, Pingarati, Romania) *In its* Proc. of the 15th Intern. Meeting on Alpine Meteorology, Vol. 2 1979 p 34-38 refs In FRENCH; ENGLISH summary (For primary document see N79-25652 16-47)
Avail: NTIS HC A04/MF A01

Hourly observations made at a Rumanian weather station over a 15 year period were analyzed. The Foehn effect which the descending local strong winds (9 - 12 m/s) produce as well as the dependence upon the thermic agent of the strong local ascending winds is revealed. The influence of the local ascending winds on the daily variations of temperature and relative humidity of the air from the opening of the mountainous valley is shown in graphs. A.R.H.

N79-25659# Utah State Univ., Logan. Dept. of Soil Science and Biometeorology
PRELIMINARY COMPARISONS OF IRRADIANCE IN THE ALPS AND ROCKY MOUNTAINS
Inge Dirmhirn *In* Schweizerischen Meteorologischen Zentralanstalt Proc. of the 15th Intern. Meeting on Alpine Meteorology, Vol. 2 1979 p 39-42 refs (For primary document see N79-25652 16-47)
Avail: NTIS HC A04/MF A01

The daily maximum and mean value throughout the year at the 10-year recording station in the Western Rocky Mountains in 1500 m at 42 deg N with stations at the same elevation in the Alps at 47 deg N were compared and show distinct differences. The amplitude of clear sky daily total global irradiance is larger in Alps as a result of the higher geographical latitude and associated larger change in daylength. On clear days, the summer values barely exceed the findings in the Rocky Mountains, which points to a compensating effect by the transmissivity of the atmosphere. Alpine, high moisture air, seems to absorb more solar irradiance. The difference in the actual average values in the two mountain ranges is so pronounced that a more in-depth

investigation of these parameters is necessary, if future predictions want to be made. A.R.H.

N79-25660# Schweizerische Meteorologische Zentralanstalt, Zurich.
GRAPHS TO DETERMINE BY A SIMPLE READING THE EFFECTIVE DAILY DIRECT SOLAR IRRADIATION OF A GIVEN SURFACE VERSUS THE HORIZONTAL DIRECTION FROM A FIXED POINT [DIAGRAMME ZUR BESTIMMUNG, DURCH EINFACHE ABLESUNG, DER EFFECTIVEN TAEGLICHEN DIREKTEN SONNENBESTRAHLUNG EINER GEGEBENEN FLAECHE IN ARHAENGIGKEIT VON DEM HORIZONTVERLAUF AM STANDPUNKT]
Jean Riblet *In its* Proc. of the 15th Intern. Meeting on Alpine Meteorology, Vol. 2 1979 p 43-46 refs In GERMAN; ENGLISH summary (For primary document see N79-25652 16-47)
Avail: NTIS HC A04/MF A01

Graphs are presented for estimating the heat amount of direct solar energy received on any given surface at any given place. The diagrams applied to the prediction of the most favorable orientation and tilt angle for a flat plate collector at a given place on a given date, with consideration of insolation reduction by shading obstructions. A.R.H.

N79-25661# Bern Univ. (Switzerland).
SIGNIFICANCE OF VARIOUS KINDS OF DATA FOR RECONSTRUCTION OF CLIMATE AND WEATHER EVOLUTION IN THE LAST CENTURIES [DIE BEDEUTUNG VERSCHIEDENER DATENTIPEN FUER DIE REKONSTRUKTION DES KLIMA-UND WITTERUNGSVERLAUFS DER LETETEN JAHKHUNDERTE]
Ch. Pfister, B. Messerli, P. Messerli, and H. J. Zumbuehl *In* Schweizerischen Meteorologischen Zentralanstalt Proc. of the 15th Intern. Meeting on Alpine Meteorology, Vol. 2 1979 p 47-48 refs In GERMAN (For primary document see N79-25652 16-47)
Avail: NTIS HC A04/MF A01

Historical data on weather and climate in Switzerland in the last three centuries were analyzed. The available data were divided into direct (old measurement series, noninstrumental weather records, climatologic data bank) and indirect materials (reproduction of glacier images and reports of glacier movements). The latter data are found to be in agreement with direct measurements of hygrometric and thermal indices. All data types indicate a cooling trend in the second half of the 16th century and three shorter cold periods within the same time. Author

N79-25662*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
GROUND WINDS FOR KENNEDY SPACE CENTER, FLORIDA, 1979 REVISION
D. L. Johnson and S. C. Brown Jun. 1979 192 p refs Revised
(NASA-TM-78229) Avail: NTIS HC A09/MF A01 CSCL 04B

Revised ground-level runway wind statistics for the Kennedy Space Center, Florida area are presented. Crosswind, headwind, tailwind, and headwind reversal percentage frequencies are given with respect to month and hour for the Kennedy Space Center Space Shuttle runway. G.Y.

N79-25663# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
A NON-INTEGRATED, ADIABATIC, THREE-LEVEL FILTERED WEATHER PREDICTION MODEL
Hilarie A. Riphagen and Alewyn P. Burger (Office of the Scientific Advisor to the Prime Minister, Pretoria) Oct. 1978 28 p refs (CSIR-S-WISK-7) Avail: NTIS HC A03/MF A01

A simplified linear balanced weather prediction model is described, and its performance discussed in hemispherical prediction as a back-up to a sophisticated primitive equation model of the South African Weather Bureau. The model is adiabatic, use is made of non-integrated forms of the equations for three reference levels with pressure as vertical coordinate, and orography and Ekman surface friction are taken into account. Vertical profiles are piecewise linear for horizontal velocity, piecewise quadratic for vertical motion and logarithmic in the troposphere for temperature. At the outer boundary horizontal velocity vanishes, while omega vanishes quadratically. Simple centered differences are used, while a Robert time filter and a Shapiro smoother are applied at each time step. Without finer tuning, the performance in middle latitudes was comparable to that of the operational model, and vertical motion was handled well, while movement of features in the subtropics still tended to be too slow. Author

N79-25664*# National Aeronautics and Space Administration, Washington, D. C.
STUDIES ON REMOTE SENSING METHOD OF PARTICLE SIZE AND WATER DENSITY DISTRIBUTION IN MISTS AND CLOUDS USING LASER RADAR TECHNIQUES
Hiroshi Shimizu (Natl. Inst. for Environmental Studies, Ibaraki, Japan), Takao Kobayasi (Tohoku Univ.), and Humio Inaba (Tohoku Univ.) Jun. 1979 19 p refs Transl. into ENGLISH from Oyo Butsuri (Japan), v. 47, no. 1, 1978 p 3036 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75354) Avail: NTIS HC A02/MF A01 CSCL 04B

A method of remote measurement of the particle size and density distribution of water droplets was developed. In this method, the size of droplets is measured from the Mie scattering parameter which is defined as the total-to-backscattering ratio of the laser beam. The water density distribution is obtained by a combination of the Mie scattering parameter and the extinction coefficient of the laser beam. This method was examined experimentally for the mist generated by an ultrasonic mist generator and applied to clouds containing rain and snow. Compared with the conventional sampling method, the present method has advantages of remote measurement capability and improvement in accuracy. Author

N79-25665*# FWG Associates, Inc., Tullahoma, Tenn.
A REVIEW OF THE METEOROLOGICAL PARAMETERS WHICH AFFECT AERIAL APPLICATION Final Report
Larry S. Christensen and Walter Frost Wallops Island, Va. NASA Jun. 1979 132 p refs
(Contract NAS6-2871)
(NASA-CR-156840) Avail: NTIS HC A07/MF A01 CSCL 04B

The ambient wind field and temperature gradient were found to be the most important parameters. Investigation results indicated that the majority of meteorological parameters affecting dispersion were interdependent and the exact mechanism by which these factors influence the particle dispersion was largely unknown. The types and approximately ranges of instrumented capabilities for a systematic study of the significant meteorological parameters influencing aerial applications were defined. Current mathematical dispersion models were also briefly reviewed. Unfortunately, a rigorous dispersion model which could be applied to aerial application was not available. R.E.S.

N79-25666*# National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.
AN ATLAS OF 1976 GEOS-3 RADAR ALTIMETER DATA FOR TROPICAL CYCLONE STUDIES
H. Ray Stanley, Barbara Chan (Wolf Res. and Develop. Corp., Pocomoke City, Md.), Cindy Givens (Wolf Res. and Develop. Corp., Pocomoke City, Md.), and Ronald Taylor (Wolf Res. and Develop. Corp., Pocomoke City, Md.) Apr. 1979 202 p refs
(NASA-TM-73282) Avail: NTIS HC A10/MF A01 CSCL 04B

The means for locating and extracting GEOS-3 altimeter data acquired for the analysis of specific hurricanes, typhoons, and other tropical cyclones are presented. These data are also expected to be extremely useful in the analysis of the behavior of the altimeter instrument in the presence of severe meteorological disturbances as well as provide a data base which can be useful in the resolution of apparently anomalous geoid or sea surface characteristics. Geographic locations of 1976 tropical cyclones were correlated with the closest approaching orbits of the GEOS-3 satellite and its radar altimeter. The cyclone locations and altimeter data were correlated for the 1976 season. The area of coverage includes the northern hemisphere. This document is a sequel to NASA TM-X-69364 which covered the majority of the 1975 season. M.M.M.

N79-25667*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
METEOROLOGICAL AND OPERATIONAL ASPECTS OF 46 CLEAR AIR TURBULENCE SAMPLING MISSIONS WITH AN INSTRUMENT B-57B AIRCRAFT. VOLUME 1: PROGRAM SUMMARY
Richard E. Davis, Robert A. Champine, and L. J. Ehernberger May 1979 79 p refs Prepared in cooperation with NASA, Dryden Flight Res. Center
(NASA-TM-80044) Avail: NTIS HC A05/MF A01 CSCL 04B

The results of 46 clear air turbulence (CAT) probing missions conducted with an extensively instrumented B-57B aircraft are summarized. Turbulence samples were obtained under diverse conditions including mountain waves, jet streams, upper level fronts and troughs, and low altitude mechanical and thermal turbulence. CAT was encouraged on 20 flights comprising 77 data runs. In all, approximately 4335 km were flown in light turbulence, 1415 km in moderate turbulence, and 255 km in severe turbulence during the program. The flight planning, operations, and turbulence forecasting aspects conducted with the B-57B aircraft are presented. S.E.S.

N79-25668# Florida Technological Univ., Orlando. Dept. of Mathematics and Statistics.
SOME MODELS FOR SKY COVER SR-2
Paul N. Somerville, Sharon Watkins, and Richard Daley 31 Aug. 1978 25 p
(Contract F19628-77-C-0080)
(AD-A062650; AFGL-TR-78-0219) Avail: NTIS HC A02/MF A01 CSCL 04/2

Models for predicting the climatological probability of a given amount of sky cover at a given time and for seven diverse locations are developed. The first models are for specific months and times of day (96 models, one for each month and three hour period of the day). The second models are general models and day of the year and hour of the day are model inputs. Estimates of amounts of error to be expected when using the model are given. Author

N79-25669*# Stanford Univ., Calif. Inst. for Plasma Research.
SOLAR VARIABILITY AND TERRESTRIAL WEATHER
Philip H. Scherrer Apr. 1979 29 p refs Submitted for publication
(Contract NAS5-24420; Grant NGR-05-020-559; Contract N00014-76-C-0207; Grant NSF ATM-77-20580)
(NASA-CR-158712; SUIPR-786) Avail: NTIS HC A03/MF A01 CSCL 04B

Possible relationships between terrestrial weather and solar or solar wind variability were investigated. Correlations were sought on three time scales: (1) climate changes over hundreds to thousands of years, related to longer term variations in the solar putput, (2) climate changes correlated with the 22 year solar cycle, and (3) weather variations on the scale of a few days, in response to transient solar events. While it was not conclusively shown that there is a sun-weather connection on any of these time scales, in each case there exists enough supporting evidence to suggest that further study is warranted. R.E.S.

N79-25670*# Texas A&M Univ., College Station. Dept. of Meteorology
DIFFERENCES BETWEEN MEASURED AND LINEARLY INTERPOLATED SYNOPTIC VARIABLES OVER A 12-h PERIOD DURING AVE 4
Leonard R. Dupuis and James R. Scoggins Jun. 1979 136 p refs
(Contract NAS8-31773)
(NASA-CR-3150; M-284) Avail: NTIS HC A07/MF A01 CSCL 04B

Results of analyses revealed that nonlinear changes or differences formed centers or systems, that were mesosynoptic in nature. These systems correlated well in space with upper level short waves, frontal zones, and radar observed convection, and were very systematic in time and space. Many of the centers of differences were well established in the vertical, extending up to the tropopause. Statistical analysis showed that on the average nonlinear changes were larger in convective areas than nonconvective regions. Errors often exceeding 100 percent were made by assuming variables to change linearly through a 12-h period in areas of thunderstorms, indicating that these nonlinear changes are important in the development of severe weather. Linear changes, however, accounted for more and more of an observed change as the time interval (within the 12-h interpolation period) increased, implying that the accuracy of linear interpolation increased over larger time intervals. Author

N79-25671# Air Force Geophysics Lab., Hanscom AFB, Mass.
FIELD TEST RESULTS OF A LASER DOPPLER VELOCIMETER AND AN ACOUSTIC DOPPLER WIND SOUND Final Report
Frederick J. Brousaides 1 Nov. 1978 51 p refs
(AF Proj. 6670)
(AD-A066945; AFFGL-TR-78-0275; AFGL-IP-273) Avail: NTIS HC A04/MF A01 CSCL 04/2

A field test program was conducted to evaluate the potential of two indirect wind sensing techniques as possible support in a warm fog dispersal system. The sensors examined were a Laser Doppler Velocimeter and an Acoustic Doppler Wind Sounder. Data from these devices were correlated with measurements taken by anemometers mounted upon a 61-m meteorological tower. The average deviation of the Laser Doppler Velocimeter was + or - 1.0 m/sec in wind speed and + or - 7 deg in azimuth. Five-minute averaging periods were taken and four to six altitudes were scanned during each run. The average deviation of the Acoustic Doppler Wind Sounder for 5-min averages was + or - 0.9 m/sec in wind speed and + or - 13 deg in azimuth. In one protracted run using 10-min averages, the deviations were + or - 0.6 m/sec in wind speed and + or - 6 deg in azimuth. GRA

N79-25672# Sutron Corp., Arlington, Va.
DEMONSTRATION OF ADAPTIVE RANDOM REPORTING GOES DATA COLLECTION SYSTEM Final Report, 14 Mar. 1978 - 15 Jan. 1979
Duane M. Preble 15 Jan. 1979 168 p
(Contract DACW33-78-C-0176)
(AD-A067290; SCR-333-78-006) Avail: NTIS HC A08/MF A01 CSCL 17/2

New England Division has demonstrated a random reporting capability for collecting data using a standard 1500Hz channel on NOAA's GOES satellite. The new mode has several advantages over scheduled or interrogation modes used to collect hydrometeorologic data required in reservoir regulation in New England. In the random reporting system, hundreds of data collection platforms transmit on a single channel at proper (random) time intervals to insure an acceptable probability of reception. Several techniques have been incorporated to improve reception probabilities, the main ones being a short message (less than 2 seconds) and an adaptive algorithm programmed into each platform. This algorithm assures sufficient transmissions during critical times, yet relieves the system of superfluous messages during normal periods when no new or important information has been generated. The demonstration has confirmed that, even without the adaptive feature, at least 200 platforms will report successfully (with 90% probability) within an hour; and the research has revealed future enhancements which could increase the number of platforms by an order of magnitude. A new platform designed around readily available components is now operable and is expected to bring costs within reach of many users. Author (GRA)

N79-25673# California Univ., Berkeley. Statistical Lab.
STRONG FAR-AWAY EFFECTS OF LOCAL CLOUD SEEDING. PROGRESS IN TECHNOLOGY DEPENDS ON INTENSE STUDIES OF THESE PHENOMENA
Jerzy Neyman 1979 36 p refs
(Contract N00014-75-C-0159)
(AD-A066517; ONR-79-01) Avail: NTIS HC A03/MF A01 CSCL 04/2

The Public Law 94-490 of 1974 directs the Secretary of Commerce to formulate an appropriate national policy on weather modification. This event stimulated publication of 'A statistician's view of weather modification technology,' (Proc. Natl. Acad. Sci., Vol. 74, 1977). The present Technical Report is similarly motivated. It assembles evidence of an unexpected phenomenon: the seeding

of clouds intended to affect the precipitation in a conventional target, perhaps some 50 km across, appears to have strong effects on rain at distances of 140-280 km, 'the far-away effects.' The hypothetical atmospheric physics mechanism described in the Report explains some of the empirical findings, but not all. The particularly interesting unexpected finding refers to the seven year long Arizona experiment: an apparent 74% increase in rain (P–0.047) in far-away localities on the right of the day's wind direction. The statistical methodology used is a combination of 'moving grids' and of optimal C(alpha) tests. Author (GRA)

N79-25674# Science Applications, Inc., La Jolla, Calif.
SATELLITE MEASUREMENTS OF ATMOSPHERIC AEROSOLS Annual Report, 1 Apr. 1978 - 31 Mar. 1979
M. Griggs 31 Mar. 1979 18 p refs
(Contract N00014-77-C-0489)
(AD-A066744; SAI-011-79-633-LJ) Avail: NTIS HC A02/MF A01 CSCL 04/2

Measurements of the atmospheric aerosol optical thickness were made during the 1977 EOMET cruise across the Atlantic Ocean and the Mediterranean Sea. These data were obtained at the same time as NOAA-5 and GOES visible radiance measurements in the vicinity of the ship. Linear relationships between the upwelling radiance and the aerosol optical thickness were found for each satellite, confirming earlier Landsat results. Differences in the relationships for each satellite are attributed to differences in the radiometric calibrations of the satellite sensors. Author (GRA)

N79-25675# Naval Environmental Prediction Research Facility, Monterey, Calif.
USE OF A SECOND-MOMENT TURBULENCE CLOSURE MODEL FOR COMPUTATION OF REFRACTIVE INDEX STRUCTURE COEFFICIENTS Final Report
Stephen D. Burk Dec. 1978 60 p refs
(AD-A066742; NEPRF-TR-78-04) Avail: NTIS HC A04/MF A01 CSCL 04/2

A one-dimensional second-moment turbulence closure model which includes a detailed radiative transfer scheme and a parameterized cloud physics is described. The Reynolds equations are developed from the primitive set of equations and the necessary closure assumptions are discussed. The nature of initial and boundary conditions required by the model, both for the mean and the turbulence variables, is presented. GRA

N79-25676# Naval Postgraduate School, Monterey, Calif.
A STUDY OF INTERANNUAL AND INTRAANNUAL TROPICAL ATMOSPHERIC CIRCULATIONS DURING NORTHERN HEMISPHERE SUMMER M.S. Thesis
Earle Lesie McCormick Dec. 1978 57 p refs
(AD-A066390) Avail: NTIS HC A04/MF A01 CSCL 04/2

This thesis contains a study of the interannual and intraannual tropical atmospheric circulations for the Northern Hemisphere summer seasons of 1974, 1975 and 1976 using satellite observations of of infrared radiation and albedo in conjunction with parameters available from conventional 200 mb data. The 200 mb flow regimes are contrasted for the three seasons and power spectra and cross-spectral analysis are used to find significant correlations between the parameters from time series generated within a given area and between the areas. These areas were picked for each parameter to represent regions of maximum time-averaged values. The anomalously warm sea surface temperatures in 1976 Bepristis, 1977 occurred in conjunction with major circulation changes paralleling Bjerknes 1969 hypothesis and the differences in flow regimes between a normal and dry monsoon season the differences in flow regimes between a normal and dry monsoon season are in general agreement with Kanamitsu and Krishnamurti 1978. Significant correlations were found to exist between parameters within the eastern Pacific and western Pacific and also between these two regions. Particularly strong correlations involved the sq u, sq v and ir parameters. Author (GRA)

N79-25677# Florida State Univ., Tallahassee. Dept. of Statistics.
SOME APPROACHES TO STATISTICAL ANALYSIS OF A WEATHER MODIFICATION EXPERIMENT
Ralph A. Bradley, Sushil S. Srivastava, and Adolf Lanzdorf Jan. 1979 53 p refs
(Contract N00014-76-C-0394)
(AD-A066383; FSU-Statistics-M490; TR-135-ONR) Avail: NTIS HC A04/MF A01 CSCL 04/2

Data from a weather modification experiment are examined and a number of statistical analyses reported. The validity of earlier inferences is studied as are the utilities of various statistical methods. The experiment is described. The original analysis of North Americal Weather Consultants, who conducted the experiments, is reviewed. Data summarization is reported. A major approach to analysis is through the use of cloud-physics covariates in regression analyses. Finally, a multivariate analysis is discussed. It appears that the covariates may have been affected by treatment cloud seeding and that their use is invalid, not only reducing error variances but removing treatment effect. Some recommendations for improved design of similar future experiments are given in a concluding section, including preliminary trial use of blocking by storms. Author (GRA)

N79-25678# Systems and Applied Sciences Corp., Riverdale, Md.
SYNOPTIC ANALYSIS CASE 3, 23 FEBRUARY 1977 - 25 FEBRUARY 1977
Don Chin and Harry D. Hamilton Jan. 1979 103 p
(Contract F19628-78-C-0138; AF Proj. 2310)
(AD-A066981; Scientific-3; AFGL-TR-79-0021) Avail: NTIS HC A06/MF A01 CSCL 04/2

The synoptic scale weather conditions over the continental United States for the period 23-25 February 1977 are documented in support of the Large Scale Cloud Systems Program. Included in this report are the flight tracks of the research aircraft, a narrative description, and analyses of meteorological parameters from the surface to 200 mb. Author (GRA)

N79-25679# Air Force Geophysics Lab., Hanscom AFB, Mass.
CIRRUS PARTICLE DISTRIBUTION STUDY, PART 3 Air Force Surveys in Geophysics
Donald J. Varley 11 Dec. 1978 65 p
(AD-A066975; AFGL-TR-78-0305-Pt-3; AFGL-AFSG-404)
Avail: NTIS HC A04/MF A01 CSCL 04/2

This report describes particle spectra in thin cirrus clouds that were sampled on 18 March 1978 southwest of Albuquerque. The sampling aircraft, an MC-130E, flew near 31,000 ft (9.4 km) and acquired cloud particle data with its three PMS spectrometer probes. Ice crystals larger than 50 micrometer were recorded for only about 17 min, but smaller ones were measured by an axial scattering probe for several more minutes. Listings of particle concentration vs size, averaged over consecutive 30 sec intervals for 75 min, are included. Author (GRA)

N79-25680# Naval Environmental Prediction Research Facility, Monterey, Calif.
LEVEL ASSIGNMENT IN THE ASSIMILATION OF SATELLITE CLOUD-TRACKED WINDS Final Report
David H. Lee Dec. 1978 74 p refs
(AD-A067079; NEPRF-TR-78-03) Avail: NTIS HC A04/MF A01 CSCL 04/2

Heights assigned to wind vectors derived from geostationary satellite data cannot be determined exactly. When these vectors are assimilated into numerical models or analyses which define finite layers in the vertical, a compounding of errors may result. In this study, the method of determining the insertion level within an assimilation system is varied in an attempt to minimize these errors and study their effect on the resultant analyses. Analyses from the four methods of level determination were compared to each other and to the control experiment. Results show that slight differences in the level of insertion can produce meaningful differences in the resulting analyses, and also confirm the value of cloud winds in data-sparse regions. Advantages and disadvantages of the wind insertion methods are discussed. GRA

N79-25681# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
THE 19303A GSRS MISSILE NUMBER 1018 AND NUMBERS V-17 AND V-18, 1 FEBRUARY 1979
Mar. 1979 22 p
(DA Proj. 1T6-65702-D-127)
(AD-A066884; ECOM-DR-988) Avail: NTIS

HC A02/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 19303A GSRS, Missile Numbers 1018 and 1017, Round Numbers V-17 and V-18, are presented in tabular form. Author (GRA)

N79-25682# Naval Research Lab., Washington, D. C.
OPTICAL EXTINCTION PREDICTIONS FROM MEASUREMENTS ON THE OPEN SEA Interim Report
G. L. Trusty and T. H. Cosden 19 Jan. 1979 26 p refs
(AD-A066898; AD-E000281; NRL-8260) Avail: NTIS HC A03/MF A01 CSCL 04/2

From aerosol measurements made aboard a ship in the open sea, we calculated extinction coefficients at several optical wavelengths, using the size distribution and Mie theory. We made the measurements at points along a path from the coast of Virginia to Rota, Spain, then into the Mediterranean to Greece. Most of the measurements were made under moderate to high visibility conditions, but fog was encountered once. The measurements are limited by ship influences. Author (GRA)

N79-25683# Kiel Univ. (West Germany). Inst. fuer Meereskunde.
EXCHANGE PROCESSES IN THE FLENSBURGER FJORD Final Report
Ursula Schauer Bonn Bundeshin. fuer Forsch. u. Technol. Dec. 1977 69 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-M-77-04) Avail: NTIS HC A04/MF A01; ZLDI, Munich DM 14.50

Measurements are evaluated which were obtained in Autumn 1972 in the Flensburger fjord. The currents are mainly caused by the local wind. Winds from the west set up a vertical circulation pattern consisting of outflow in the surface layer, inflow in the lower layer, and upwelling in the inner region. Lateral countercurrents at the entrance of the fjord are not explained by the influence of the Coriolis force alone. The exchange of water depends on meteorological events and has typical scales of several days. Advection of water from the Kiel Bight is more important for water renewal than mixing. In a model the setup of a wind-driven circulation pattern and its influence on an originally horizontal homogeneous stratification is described. It turns out that the influence of internal density differences on velocity is negligible during most of the transition from the state of rest to the stable state. Author (ESA)

N79-25684# National Oceanic and Atmospheric Administration, Boulder, Colo. Air Resources Lab.
NOAA AIR RESOURCES LABORATORIES STRATOSPHERIC LIDAR PROJECT 1976 RESULTS
Ronald W. Fegley Sep. 1978 15 p refs
(PB-293568/2; NOAA-TR-ERL-500; NOAA-79022701) Avail: NTIS HC A02/MF A01 CSCL 04B

Stratospheric aerosols taken biweekly, using a ruby laser with a wavelength of 694.3 nm are reported for 1976. Nine profiles of the non-Rayleigh backscatter coefficient are plotted and tabulated throughout the lower stratosphere from 16 to 25 km. These aerosols, which are of climatic importance, displayed a decreasing trend during 1976 as the stratosphere recovered from the October 1974 eruption of Fuego volcano in Guatemala (14.5 degrees N, 91 degrees W). GRA

N79-25685# Iowa State Univ. of Science and Technology, Ames.
WATER BUDGET OF CUMULONIMBUS CLUSTERS AND OF THE PENINSULAR SCALE OVER SOUTH FLORIDA Final Report
Anthony R. Hansen and John M. Brown Dec. 1978 231 p refs
(Grant NOAA-04-7-022-44030)
(PB-293590/6; NOAA-79022803) Avail: NTIS HC A11/MF A01 CSCL 04B

A water budget for 4 thunderstorm clusters over southern Florida was computed using data from face wind observations at 30-35 locations within a 32 by 45 km area just south of Lake Okeechobee, rainfall during consecutive 15 min intervals, digital radar reflectivity, upper-air observations, and time-lapse photography from several locations within the surface network. The case-study days each featured the development, during afternoon hours, of a multicell thunderstorm cluster confined mainly within the bounds of the surface wind network. Surface convergence covering a sizable portion of the network preceded the appearance of radar echoes in each case and was typically largest during a period of simultaneous rapid growth of several adjacent cumulus congestus into cumulonimbus. GRA

N79-25686# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.
THE USE OF RADAR FOR STUDIES OF CLOUDS
E. E. Gossard Jul. 1978 123 p refs
(PB-293586/4; NOAA-TM-ERL-WPL-39; NOAA-79030608) Avail: NTIS HC A06/MF A01 CSCL 04B

The ways in which cloud detecting radars might be of value at a weather observation station are suggested. It is concluded that cloud detection radars can potentially play a useful role in weather observation. However, at the present stage they provide little quantitative information and the relation of radar echoes to visual clouds remains obscure. Measurement by radars of reflectivity, attenuation, and polarization are examined and specific recommendations for their uses are made. GRA

N79-25687# National Severe Storms Lab., Norman, Okla.
A DUAL DOPPLER VARIATIONAL OBJECTIVE ANALYSIS AS APPLIED TO STUDIES OF CONVECTIVE STORMS
Conrad L. Ziegler Nov. 1978 129 p refs
(PB-293581/5; NOAA-TM-ERL-NSSL-85; NOAA-79030609) Avail: NTIS HC A07/MF A01 CSCL 04B

The tangible gains that can be realized through application of all known information in determining velocities, including Doppler measurements, kinematic constraints, Doppler measurement errors, and general knowledge of severe storm structure based on theoretical and numerical models are demonstrated. The technique is applied to the analysis of Doppler data in selected convective storms where results from a conventional dual Doppler analysis and of three or four radar analyses are available. An evaluation of the relative merits of the various analyses is performed. The technique is applied to a study of the structure and evolution of an isolated hail-bearing convective storm. GRA

N79-25688# Massachusetts Inst. of Tech., Cambridge.
INVESTIGATIONS OF THE RELATIONS OF AIR MOTIONS AND MICROPHYSICAL PROCESSES TO THE DISTRIBUTION OF PRECIPITATION ASSOCIATED WITH CUMULUS UPDRAFTS Final Report
Pauline M. Austin and Man Kong Yau Jan. 1979 38 p refs (Grant NOAA-04-5-022-1)
(PB-293518/7; NOAA-79022711) Avail: NTIS HC A03/MF A01 CSCL 04B

Research to investigate the relation of air motions and microphysical processes associated with cumulus updrafts to the distribution of precipitation and radar reflectivity is reported. Three aspects of the research were: (1) extension of the parameterization scheme to include the ice phase and further tests of the parameterization for sensitivity to various assumptions and for potential in developing realistic drop-size distributions; (2) formulation of a downdraft circulation for inclusion in the model; and (3) performance of some experiments with a two-dimensional axisymmetric model and with a full three-dimensional kinematic model. GRA

N79-25689# Wyoming Univ., Laramie. Dept. of Atmospheric Science.
CLOUD PHYSICS INVESTIGATIONS BY THE UNIVERSITY OF WYOMING IN HIPLEX (HIGH PLAINS COOPERATIVE EXPERIMENT) Annual Report, Jan. 1977 - Apr. 1978
William A. Cooper Aug. 1978 325 p refs
(Contract DI-7-07-93-V0001)
(PB-292582/4; AS119) Avail: NTIS HC A14/MF A01 CSCL 04B

In association with the High Plains Cooperative Program, summertime convective clouds in Montana were studied using an instrumented research aircraft. Climatological characteristics of the clouds are presented and precipitation mechanisms in those clouds are discussed. Ice crystal concentrations, ice origins and ice multiplication mechanisms are discussed. Several instrumentation topics are treated, including a new technique

for vertical wind measurement and intercomparisons between different hydrometeor samplers. Descriptions of the Queen Air instrumentation and the new Super King Air data system are also presented. A series of appendices contain detailed case studies from HIPLEX 1977. GRA

N79-25690# Environmental Sciences Research Lab., Research Triangle Park, N.C.
REGIONAL AIR POLLUTION STUDY: LAMBERT FIELD GRAPHICAL WEATHER SUMMARY
Robert B. Jurgens and William Ted Smith (Potomac Res., Inc., Research Triangle Park, N. C.) Jan. 1979 44 p
(PB-292286/2; EPA-600/4-79-001) Avail: NTIS HC A03/MF A01 CSCL 04B

A graphical summary of National Weather Service (NWS) 3-hour weather observations from Lambert Field Airport, St. Louis, Missouri was prepared for use by individuals involved in the analysis and application of Regional Air Pollution Study (RAPS) data. It is intended as a reference for selecting study periods with specific weather conditions or for determining weather conditions that existed during periods under investigation. The summary covers the data collection phase of RAPS from July 1974 through June 1977. All graphs are presented on a monthly basis. The following quantities were observed and are graphed: wind speed, wind direction, relative humidity, dry bulb temperature, sea level pressure, visibility, total sky cover, and ceiling height. GRA

N79-25691# National Environmental Satellite Service, Washington, D. C. Meteorological Satellite Lab.
WIND ANALYSIS BY CONDITIONAL RELAXATION
Albert Thomasell, Jr. Jan. 1979 33 p refs
(PB-293740/7; NOAA-TR-NESS-77; NOAA-79022204) Avail: NTIS HC A03/MF A01 CSCL 04A

An objective wind analysis model for processing and evaluating satellite-derived winds is described in detail. Examples of applications of the model illustrate its adaptability to problems involving wind evaluation and the analysis and modification of wind fields. GRA

N79-25692# National Oceanic and Atmospheric Administration, Washington, D. C. Environmental Data and Information Service.
MARINERS WEATHER LOG, VOLUME 23, NO. 1
Elwyn E. Wilson Jan. 1979 73 p refs
(PB-293986/6; NOAA-79022706) Avail: NTIS HC A04/MF A01 CSCL 04B

Articles on forecasting hurricane waves, ocean information systems and the Columbia River bar are presented along with the regular weather logs. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N79-25693# Council for Scientific and Industrial Research, Pretoria (South Africa).
REVIEW OF COASTAL CURRENTS IN SOUTHERN AFRICAN WATERS
T. F. W. Harris Aug. 1978 109 p refs
(CSIR-30; ISBN-0-7988-13094-6) Avail: NTIS HC A06/MF A01

A review was made of existing knowledge of the coastal currents in Southern African waters between Pta do Ouro on the northeast border, and the Orange River on the west coast. These waters were divided into five sectors. For each, the larger scale forcing mechanisms are discussed and the results of localized studies summarized. The former involve consideration of, inter alia, the influence of the Agulhas Current on the east coast and the wind stress on the south and west coasts. The latter, the local studies, contain the results of investigations which were carried out mainly for coastal engineering and effluent problems. Because of the nature of the data it was necessary to restrict the review, almost entirely, to surface currents. Where possible, wave driven currents (nearshore circulations) are included. G.Y.

N79-25694*# California Univ., Los Angeles. Dept. of Earth and Space Sciences.
STUDIES OF OCEANIC TECTONICS BASED ON GEOS-3 SATELLITE ALTIMETRY Final Report
K. A. Poehls, W. M. Kaula, G. Schubert, and D. Sandwell Apr. 1979 39 p refs
(Contract NAS6-2463)
(NASA-CR-156854) Avail: NTIS HC A03/MF A01 CSCL 08J

Using statistical analysis, geoidal admittance (the relationship between the ocean geoid and seafloor topography) obtained from GEOS-3 altimetry was compared to various model admittances. Analysis of several altimetry tracks in the Pacific Ocean demonstrated a low coherence between altimetry and seafloor topography except where the track crosses active or recent tectonic features. However, global statistical studies using the much larger data base of all available gravimetry showed a positive correlation of oceanic gravity with topography. The oceanic lithosphere was modeled by simultaneously inverting surface wave dispersion, topography, and gravity data. Efforts to incorporate geoid data into the inversion showed that the base of the subchannel can be better resolved with geoid rather than gravity data. Thermomechanical models of seafloor spreading taking into account differing plate velocities, heat source distributions, and rock rheologies were discussed. R.E.S.

N79-25695# Naval Postgraduate School, Monterey, Calif.
MASS, SALT, AND HEAT TRANSPORT ACROSS FOUR LATITUDE CIRCLES IN THE SOUTH ATLANTIC OCEAN M.S. Thesis
J. Robert Mason Dec. 1978 122 p refs
(AD-A066368; NPS68-78-007) Avail: NTIS HC A06/MF A01 CSCL 08/3

In this report classic dynamic height calculations were made from International Geophysical Year (1957-1958) and adjacent 1959 oceanographic data to obtain geostrophic currents and estimates of mass, salt, and heat transports in the South Atlantic Ocean. The cross sections extend from South America to Africa along the 8 deg. S, 16 deg. S, 24 deg. S, and 32 deg. S. latitude lines, providing temperature and salinity data from the surface to near bottom. A level of no motion was determined by establishing mass and salt continuity across each of the latitudinal cross sections. This level varied from 1100 meters at 8 deg. S to 1270 meters at 32 deg. S. It is approximated by the 27.57 sigma-t surface and corresponds closely to the boundary between the Antarctic Intermediate Water and the South Atlantic Deep Water masses. The resulting meridional heat transport was then examined and compared with other estimates. Northward (equatorward) heat transports resulted at each latitude, which would seem to oppose the conventional view of the role of the Ocean in the earth's heat budget as a means to transfer heat from equator to poles. However, the northward direction of the net absolute heat transport agrees with the consensus of previous work and is attributed to the warmer surface currents with a net northward transport dominating the cooler deeper currents and their net southward flow. GRA

N79-25696# Naval Postgraduate School, Monterey, Calif.
PRODUCTION OF ULTRA LOW FREQUENCY MAGNETIC NOISE BY OCEAN SURFACE GRAVITY WAVES M.S. Thesis
James Francis Etro Dec. 1978 72 p refs
(AD-A066474) Avail: NTIS HC A04/MF A01 CSCL 08/3

The major environment Ultra Low Frequency (ULF), magnetic noise sources observed on the airborne AN/ASQ-81(V) optically pumped magnetometer are electromagnetic micropulsatrons, geological structures and ocean wave noise. Experimental determinations of the amount of magnetic noise produced by ocean surface gravity waves were made. The author's current research designed to remove the wave noise and increase the probability of Magnetic Anomaly Detection (MAD) is summarized. Author (GRA)

N79-25697# Naval Postgraduate School, Monterey, Calif.
THE EFFECTS OF A PRESCRIBED SALINITY FIELD ON A

10-LEVEL PRIMITIVE EQUATION OCEAN CIRCULATION MODEL M.S. Thesis
K. E. Barbor Dec. 1978 72 p refs
(AD-A066497) Avail: NTIS HC A04/MF A01 CSCL 08/10

A prescribed salinity field is inserted into a 10-level primitive equation ocean circulation model. The model has been developed and is being improved in order to study large-scale thermal anomalies observed in the Central North Pacific Ocean by the North Pacific Experiment (NOR-PAX). The salinity field, based on observations along 160 W longitude, is independent of longitude and time, and is smoothed in the north-south direction to remove small-scale variations. A new equation of state which is a function of temperature, salinity and depth is used to determine density in the calculation of pressure from the hydrostatic equation. The parameterization of vertical mixing is changed to account for the stabilizing effect of salinity and the supercooling of the surface layers at high latitudes during winter. The addition of salinity induced changes in the currents at high latitudes when compared to the model without salinity. A Rossby wave was excited in the middle latitudes which produced transient changes. The convective adjustment process enabled significantly colder water to overlie warmer water in the regions where salinity increases with depth. Supercooled surface temperatures, encountered during winter at high latitudes, are handled through convective mixing, but further investigation into the dynamics of sub-grid scale vertical convection at near freezing temperatures is recommended. Author (GRA)

N79-25698# Woods Hole Oceanographic Institution, Mass.
STUDIES OF DEEP-SEA SEDIMENTARY MICROTOPOGRAPHY IN THE NORTH ATLANTIC OCEAN Ph.D. Thesis
Roger Donald Flood Oct. 1978 299 p refs
(Contract N00014-74-C-0262; Grant NSF DES-73-06657)
(AD-A061931; WHOI-78-64) Avail: NTIS HC A17/MF A01 CSCL 08/10

Many of the small-scale topographic features (dimensions of centimeters to kilometers) found on the Blake-Bahama Outer Ridge (western North Atlantic, water depth greater than 4000 m) and in the Rockall Trough (northeastern North Atlantic, water depth greater than 2000 m) have been formed as bed forms of deep currents. These bed forms, all developed in cohesive sediments, include current ripples (spacings of tens of centimeters, formed transverse to the flow), longitudinal triangular ripples (spacings of meters, formed in sandy muds and parallel to the flow), furrows (spacings of tens to 100's of meters, formed parallel to the flow and presently either erosional or depositional), and regular sediment waves (spacings of a few kilometers, now found oblique to the flow and migrating either upstream or downstream). The local distribution of any given bed form is influenced by the presence of larger features. Bed forms are often found in zones which strike parallel to the regional contours. GRA

N79-25699# Bundesanstalt fuer Geowissenschaften und Rohstoffe, Hannover (West Germany).
INVESTIGATION OF MANGANESE NODULES FROM THE VALDIVIA CRUISE 13/1 (AND A MANGANESE CRUST FROM VALDIVIA CRUISE 13/2) Final Report
Dietrich Heye Bonn Bundesmin. Forsch. fuer u. Technol. Dec. 1977 41 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-77-07) Avail: NTIS HC A03/MF A01; ZLDI, Munich DM 8.60

External and internal growth structures were investigated together with Io-activity using nuclear plates for manganese nodules from the Pacific. At the summit and in the immediate vicinity of a sea mount, average nodule growth rates are lower than in abyssal plains. Growth rates of 0 to 10 mm/mega years are found in all regions, but more rapid growth is sometimes found on the plains. Nodules buried near the sediment surface manifest surprisingly high Io-activities and atypical internal growth structures near their surface. These characteristics indicate continued growth of buried nodules. Internal structure and alpha activity distribution comparisons exclude the possibility of Io diffusion. Author (ESA)

N79-25700# National Science Foundation, Washington, D. C. Office for the International Decade of Ocean Exploration.
COASTAL UPWELLING ECOSYSTEMS ANALYSIS. DATA REPORT 49: CARBON, CHLOROPHYLL AND LIGHT EXTINCTION FROM JOINT 2 1976 AND 1977
Richard T. Barber (Duke Univ., Durham, N. C.), Susan A. Huntsman (Duke Univ., Durham, N. C.), Jane E. Kogelschatz (Duke Univ., Durham, N. C.), Walker O. Smith (Tenn. Univ., Knoxville), Burton H. Jones (Bigelow Lab. for Ocean Sci.), Jacqueline C. Paul (Duke Univ., Durham, N. C.), Timothy Cowles (Woods Hole Oceanographic Inst.), Oscar Guillen (Inst. del Mar del Peru), Ruth Calienes (Inst. del Mar del Peru), Rosa Aquino (Inst. del Mar del Peru) et al Sep. 1978 480 p refs
(PB-293274/7; NSF/IDOE/DR-49; NSF/IDOE-79-23) Avail: NTIS HC A21/MF A01 CSCL 08A

The data presented is from the major JOINT 2 expedition of the Coastal Upwelling Ecosystems Analysis (CUEA) program, conducted off the coast of Peru near 15 degrees S from March 1976 to May 1977 and which involved seven U.S. research vessels, an aircraft, moored current meter arrays, meteorological buoys, coastal meterological stations and satellites. The carbon, chlorophyll and light data were collected on four of the research vessels: Alpha Helix, T.G. Thompson and Eastward in 1976 and Wecoma in 1977. GRA

N79-25701# Bigelow Lab. for Ocean Sciences, West Boothbay Harbor, Maine.
COASTAL UPWELLING ECOSYSTEMS ANALYSIS. BIOCHEMISTRY AND ECOLOGY OF THE PERU CURRENT: THE JASON EXPEDITION, SEPTEMBER 1976
T. T. Packard, ed. and V. Jones, ed. Oct. 1978 162 p refs
(Contract N00014-76-C-0271; Grants NSF OEC-77-18668; NSF OEC-75-23718-A01; NSF DES-75-19025)
(PB-293329/9; Contrib-78028; NSF/IDOE/CUER/TR-46; NSF/IDOE-79-24) Avail: NTIS HC A08/MF A01 CSCL 08A

Part of this expedition was focused on the deep sea biochemical processes and regulatory mechanism that control the temporal and spatial distribution of carbon and oxygen in subsurface ocean waters. These biochemical processes are respiration, dentitrification, and sulfate reduction. The second focus area of this expedition was the euphotic zone of the upwelled waters. Specifically, the transfer rates at the phytoplankton level of the food chain were investigated. GRA

N79-25702# Mississippi State Univ., Mississippi State. Dept. of Geology and Geography.
DYNAMICS OF WAVE-INDUCED CURRENTS IN SEDIMENTS
Donald M. Keady Oct. 1978 32 p refs Sponsored by the Dept. of Interior
(PB-290990/1; W79-04076; OWRT-A-999-MISS(13)) Avail: NTIS HC A03/MF A01 CSCL 08C

Small pebbles, granules, very coarse sand, coarse sand, and medium sand were placed in a wave tank in such a manner that observations could be made in each segment as waves of similar characteristics passed over them. Dyes and near-neutral buoyant balls confined in channels were used to study the motion of the water. Pressure intensities were measured at the sediment-water interface and at a fixed depth within each segment. Water movement in the three larger size sediments was readily observable and relative measures of the magnitude of the movements were obtained; water movement in the two smaller size sediments was negligible. Results indicate that the choice of theory to solve practical problems should be based on careful consideration of the magnitude of permeability, the compressibility of water, and the compressibility and cohesiveness of the grain skeleton. GRA

N79-25703# Environmental Research Inst. of Michigan, Ann Arbor. Radar and Optics Div.
SYNTHETIC APERTURE RADAR OCEAN WAVE STUDIES Final Report, Jul. 1977 - Oct. 1978
R. A. Shuckman, E. S. Kasischke, and A. Klooster Sep. 1978 112 p refs
(Contracts NOAA-7-35328; N00014-76-C-1048)
(PB-293546/8; ERIM-131700-3-F) Avail: NTIS HC A06/MF A01 CSCL 08C

Under Task 1 of this program, modulation depth (wave detectability) scans were made as a function of wave and radar system parameters on the Marineland SAR data. An optimum

radar resolution for wave detection was determined. Under Task 2, SAR data was digitized and an analysis of Gulf Stream wave refraction was performed. Under Task 3, SAR hurricane wave data was specially processed to account for azimuth wave velocity. An additional task was performed to study the feasibility of detecting ocean currents by means of aximuthal Doppler frequency shifts. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N79-25704*# Florida Agricultural and Mechanical Univ., Tallahassee. School of Pharmacy.
MICROBIAL TRANSFORMATION OF NUCLEOSIDES Final Report
S. S. Lamba 1979 17 p
(Grant NsG-2103)
(NASA-CR-158696) Avail: NTIS HC A02/MF A01 CSCL 06C

A study involving the use of coulter counter in studying the effects of neomycin on E. coli, S. aureus and A. aerogenes was completed. The purpose of this was to establish proper technique for enumeration of cells per ml. It was found that inhibitory effects on growth of E. coli and A. aerogenes, both gram negative organisms, were directly related to the concentration of neomycin used. However, in case S. aureus, a gram positive organism, a decreased inhibition was noted at higher concentrations. A paper entitled, Use of Coulter Counter in Studying Effect of Drugs on Cells in Culture 1 - Effects of Neomycin on E. coli, S. aureus and A. aerogenes, is attached in the appendix. Laboratory procedures were also established to study the effects of nucleoside antibiotic cordycepin on He La cell grown in suspension cultures. G.Y.

N79-25705*# Food and Drug Administration, Cincinnati, Ohio. Div. of Microbiology.
ECOLOGY AND THERMAL INACTIVATION OF MICROBES IN AND ON INTERPLANETARY SPACE VEHICLE COMPONENTS Quarterly Progress Report, 1 Jul. 1978 - 30 Sep. 1978
A. L. Reyes and J. E. Campbell Dec. 1978 13 p refs
(NASA Order W-13411)
(NASA-CR-158627; QPR-54) Avail: NTIS HC A02/MF A01 CSCL 06M

The experiments conducted to determine the heat resistance of Bacillus megaterium ATCC 6458 at 90 and 100 C were completed. Estimates from replicate experiments at eight percent relative humidities (less than 0.001 to 100% RH) for each temperature were computed. A Bacillus cereus strain with high heat resistance was cultured and the resistance determined in phosphate buffer (D sub 121.1 = 2.16 min and z = 8.7 C). The profile of the dry heat resistance of B. megaterium is summarized and the most resistant condition to the three spores (Bacillus subtilis var. niger, ATCC 29669, and Bacillus stearothermophilus, strain 1518) is compared. G.Y.

N79-25706# Kansas Water Resources Research Inst., Manhattan.
EFFECTS OF HEAVY METALS ESPECIALLY SELENIUM, VANADIUM AND ZIRCONIUM ON MOVEMENT, GROWTH AND SURVIVAL OF CERTAIN ANIMAL AQUATIC LIFE Completion Report, Oct. 1976 - Sep. 1978
Eugene C. Bovee 28 Jun. 1979 29 p refs
(Contract DI-14-34-0001-7159)
(PB-292563/4; CONTRIB-199; W79-04592;
OWRT-B-051-KAN(1)) Avail: NTIS HC A03/MF A01 CSCL 13B

The heavy metals Selenium, Vanadium, and Zirconium were tested for potential toxicity to the growth and swimming rates of the ciliated protozoan, Tetrahymena pyriformis. Vanadium and Zirconium were found to be less toxic in small amounts than some other metals previously tested. Neither inhibited growth significantly at amounts below five parts per million (5 ppm). Selenium as selenous acid (H2SeO3) slightly stimulated growth at 5 to 15 ppm; but as selenite (Na2SeO3) it completely blocked growth at all concentrations tested. All three metals, however, inhibited swimming at concentrations over 5 ppm, selenium being the more toxic, topping swimming in 30 ppm in less than 1 hour. Concentrations of any of the three metals above 20 ppm are detrimental to the grown and survival of Tetrahymena pyriformis. GRA

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Includes physiological factors, biological effects of radiation; and weightlessness.

N79-25707 Minnesota Univ., Minneapolis.
A COMPUTER SYSTEM FOR STATISTICAL ANALYSIS OF EEG TRANSIENTS Ph.D. Thesis
Hans Otto Lueders 1978 121 p
Avail: Univ. Microfilms Order No. 7912109

A system is described for the detection and the statistical analysis of EEG transients using computer techniques. The system can be used for quantitative classification of normal and abnormal types of transient activity. EEG wave forms classified by this method can be processed statistically in the following ways: as histograms of time and amplitude variability for any particular type of transient; as histogram of time and amplitude differences between two transients occurring in the same or different channels; as the average, standard deviation, skewness, and kurtosis at any point in time for any particular type of EEG wave form; as a statistical comparison of two or more groups of transients, by applying a combination of analysis of variance and student's t-test; and as three-dimensional spatio-temporal display of averaged specific EEG wave forms and their corresponding standard deviations. Dissert. Abstr.

N79-25708 Medical Coll. of Virginia, Richmond.
RECRUITMENT AND DISCHARGE PROPERTIES OF MOTOR UNITS IN HUMAN BRACHIAL BICEPS AND ADDUCTOR POLLICIS DURING ISOMETRIC CONTRACTIONS Ph.D. Thesis
Carl George Kukulka 1978 125 p
Avail: Univ. Microfilms Order No. 7912820

Human motor unit recruitment and discharge patterns over the entire range of isometric contractions in a predominately red muscle, adductor pollicis, and a heterogeneous muscle, biceps brachii were examined and evaluated. Using fine wire electrodes, intramuscular recordings were obtained for 49 biceps brachii units and 29 adductor pollicis units. In order to discriminate single motor units active at high forces, and electronic differentiator was employed both during the experimental sessions and later during data analysis. The discharge patterns of the motor units were evaluated by constructing interspike interval distributions, serial correlograms, and autocorrelograms. Dissert. Abstr.

N79-25709 California Univ., Santa Cruz.
EFFECTS OF SLEEP AT ALTERED AMBIENT TEMPERATURES ON ELECTROPHYSIOLOGICAL SLEEP AND THERMOREGULATORY MECHANISMS IN HUMAN SUBJECTS AND IN THE GROUND SQUIRREL (CITELLUS LATERALIS) Ph.D. Thesis
Edwin Holbert Haskell 1978 113 p
Avail: Univ. Microfilms Order No. 7911941

Hypothalamic thermoregulatory processes are severely curtailed or eliminated during REM sleep in several animal species. Panting, shivering and sweating are among the thermoregulatory mechanisms known to be affected during REM sleep in either humans or in animals. As temperatures deviate from thermoneutrality the ratio of REM sleep to total sleep time decreases. The study was undertaken to examine the effects of sleep at ambient temperatures (Ta) above and below thermoneutrality on: (1) electrophysiological stages of sleep, and (2) oxygen consumption, skin and rectal temperature, and sweat rate in human subjects. Six male subjects slept for a total of 72 nights at 21, 24, 29, 34 and 37 C. Following 7 adaptation nights at 24, 29 and 34 degrees, the subjects spent a total of 5 or 7 experimental nights at the various temperatures. Dissert. Abstr.

N79-25710 Iowa Univ., Iowa City.
AORTIC BLOOD FLOW VELOCITY DURING EXERCISE IN

MAN Ph.D. Thesis
Charles Leonardo Carter 1978 217 p
Avail: Univ. Microfilms Order No. 7912835

The relationship between exercise intensity and peak aortic flow velocity measured noninvasively and reproducibility of responses at identical work loads were determined. A Doppler system was developed that was capable of resolving flow velocities in excess of 100 cm/sec for an exercise environment. Reproducibility of that system in vitro was demonstrated using both pulsatile and continuous flow in latex and silastic tubing of different diameters and elastic properties. Thirteen normal subjects pedaled a bicycle ergometer while positioned 30 degrees from the horizontal at 20, 40, 60, and 80 percent of the individual maximal aerobic power of each subject determined from a previous session. The results indicate that blood flow velocity in the arch of the aorta increases with increasing work load. Dissert. Abstr.

N79-25711*# General Electric Co., Houston, Tex.
USER'S INSTRUCTIONS FOR THE ERYTHROPOIESIS REGULATORY MODEL
13 Mar. 1978 42 p refs
(Contract NAS9-15487)
(NASA-CR-160193; TIR-741-LSP-8004) Avail: NTIS HC A03/MF A01 CSCL 06P

The purpose of the model provides a method to analyze some of the events that could account for the decrease in red cell mass observed in crewmen returning from space missions. The model is based on the premise that erythrocyte production is governed by the balance between oxygen supply and demand at a renal sensing site. Oxygen supply is taken to be a function of arterial oxygen tension, mean corpuscular hemoglobin concentration, oxy-hemoglobin carrying capacity, hematocrit, and blood flow. Erythrocyte destruction is based on the law of mass action. The instantaneous hematocrit value is derived by integrating changes in production and destruction rates and accounting for the degree of plasma dilution. G.Y.

N79-25712*# General Electric Co., Houston, Tex.
STUDY REPORT ON A DOUBLE ISOTOPE METHOD OF CALCIUM ABSORPTION
10 Jul. 1978 7 p refs
(Contract NAS9-15487)
(NASA-CR-160194; TIR-741-LSP-8009) Avail: NTIS HC A02/MF A01 CSCL 06P

Some of the pros and cons of three methods to study gastrointestinal calcium absorption are briefly discussed. The methods are: (1) a balance study; (2) a single isotope method; and (3) a double isotope method. A procedure for the double isotope method is also included. . G.Y.

N79-25713*# General Electric Co., Houston, Tex.
STRONTIUM METABOLISM IN THE REBUILDING OF SKELETAL TISSUE
10 Jul. 1978 9 p refs
(Contract NAS9-15487)
(NASA-CR-160195; TIR-741-LSP-8010) Avail: NTIS HC A02/MF A01 CSCL 06P

The relationship between calcium and strontium in bone metabolism is described. Whole body comparisons in the form of balance studies, plasma kinetics, and biochemical bone differences are briefly reviewed. The value of strontium as a qualitative calcium mimetic is established. A procedure of strontium deposition in the bones is presented as a means to study postflight bone rebuilding and to locate areas of inflight demineralization. G.Y.

N79-25714*# General Electric Co., Houston, Tex.
THE INFLUENCE OF EXERCISE ON BONE ATROPHY
10 Jul. 1978 5 p refs
(Contract NAS9-15487)
(NASA-CR-160196; TIR-741-LSP-8011) Avail: NTIS HC A02/MF A01 CSCL 06P

The relationship between the skeletal system, the muscular system, and exercise in bed rest studies are described. The regime of exercises performed, the mineral balance data derived, and the bone densitometric data obtained are discussed. A brief review of some of the histological results are also given. G.Y.

N79-25715*# General Electric Co., Houston, Tex.
A BRIEF REVIEW OF SPACE FLIGHT CALCIUM METABOLISM: RESULTS AND METHODOLOGIES
18 Jul. 1978 24 p refs
(Contract NAS9-15487)
(NASA-CR-160198; TIR-741-LSP-8015) Avail: NTIS HC A02/MF A01 CSCL 06P

Space flight induced osteoporosis was described. The techniques that were used to measure and detect the osteoporosis were also described. Areas of calcium metabolism were shown to be very important in the investigation into more sensitive detection and measurement techniques of bone demineralization. R.E.S.

N79-25716*# General Electric Co., Houston, Tex.
PRELIMINARY DESIGN SPECIFICATIONS OF A CALCIUM MODEL
6 Oct. 1978 12 p refs
(Contract NAS9-15487)
(NASA-CR-160199; TIR-741-LSP-8022) Avail: NTIS HC A2/MF A01 CSCL 06P

A list of objectives, requirements, and guidelines are given for a calcium model. Existing models are reviewed and evaluated in relation to the stated objectives and requirements. The reviewed models were either too abstract or apparently invalidated. A technical approach to the design of a desirable model is identified. G.Y.

N79-25717*# General Electric Co., Houston, Tex.
DEVELOPMENT OF AN HYPOTHESIS FOR SIMULATING ANTI-ORTHOSTATIC BED REST
J. I. Leonard, D. J. Grounds, and D. G. Fitzjerrell 16 Oct. 1978 51 p refs
(Contract NAS9-15487)
(NASA-CR-160200; TIR-741-LSP-8023) Avail: NTIS HC A04/MF A01 CSCL 06S

The Guyton model, modified by the addition of leg compartments and the effect of the gravity vector, was used to evaluate hypotheses describing leg dehydration and fluid shifts. While the study is not complete, the basic approach was shown to be useful by identifying important mechanisms, identifying systems which need further experimental description and by assisting in the development of a general hypothesis. G.Y.

N79-25718*# Tennessee Univ., Knoxville. Dept. of Biology.
USE OF A COMPUTER MODEL IN THE UNDERSTANDING OF ERYTHROPOIETIC CONTROL MECHANISMS
C. D. R. Dunn Oct. 1978 38 p Prepared in cooperation with General Electric Co., Houston
(Contract NAS9-15487)
(NASA-CR-160201; TIR-741-LSP-8029) Avail: NTIS HC A03/MF A01 CSCL 06P

During an eight-week visit approximately 200 simulations using the computer model for the regulation of erythopoiesis were carries out in four general areas: with the human model simulating hypoxia and dehydration, evaluation of the simulation of dehydration using the mouse model. The experiments led to two considerations for the models. Firstly, a direct relationship between erythropoietin concentration and bone marrow sensitivity to the hormone and, secondly, a partial correction of tissue hypoxia prior to compensation by an increased hematocrit. This latter change in particular produced a better simuation of the effects of hypoxia on plasma erythropoietin concentrations. G.Y.

N79-25719*# General Electric Co., Houston, Tex.
A PRIORITIZED SET OF PHYSIOLOGICAL MEASUREMENTS FOR FUTURE SPACEFLIGHT EXPERIMENTS
29 Nov. 1978 12 p
(Contract NAS9-15487)
(NASA-CR-160202; TIR-741-LSP-8033) Avail: NTIS HC A02/MF A01 CSCL 06P

A set of desired experimental measurements to be obtained in future spaceflights in four areas of physiological investigation are identified. The basis for identifying the measurements was the physiological systems analysis performed on Skylab data and related ground-based studies. An approach for prioritizing the measurement list is identified and discussed with the use of examples. A prioritized measurement list is presented for each

of the following areas; cardiopulmonary, fluid-renal and electrolyte, hematology and immunology, and musculoskeletal. Also included is a list of interacting stresses and other factors present in spaceflight experiments whose effects may need to be quantified. G.Y.

N79-25720*# General Electric Co., Houston, Tex.
DYNAMIC REGULATION OF ERYTHROPOIESIS: A COMPUTER MODEL OF GENERAL APPLICABILITY
J. I. Leonard Jan. 1979 51 p refs
(Contract NAS9-15487)
(NASA-CR-160203; TIR-741-LSP-9005) Avail: NTIS HC A04/MF A01 CSCL 06P

A mathematical model for the control of erythropoiesis was developed based on the balance between oxygen supply and demand at a renal oxygen detector which controls erythropoietin release and red cell production. Feedback regulation of tissue oxygen tension is accomplished by adjustments of hemoglobin levels resulting from the output of a renal-bone marrow controller. Special consideration was given to the determinants of tissue oxygenation including evaluation of the influence of blood flow, capillary diffusivity, oxygen uptake and oxygen-hemoglobin affinity. A theoretical analysis of the overall control system is presented. Computer simulations of altitude hypoxia, red cell infusion hyperoxia, and homolytic anemia demonstrate validity of the model for general human application in health and disease. G.Y.

N79-25721*# General Electric Co., Houston, Tex.
USER'S INSTRUCTIONS FOR THE CARDIOVASCULAR WALTERS MODEL
R. C. Croston 11 Jan. 1973 15 p
(Contract NAS9-12932)
(NASA-CR-160204; TIR-741-MED-3006) Avail: NTIS HC A02/MF A01 CSCL 06B

The model is a combined, steady-state cardiovascular and thermal model. It was originally developed for interactive use, but was converted to batch mode simulation for the Sigma 3 computer. The model has the purpose to compute steady-state circulatory and thermal variables in response to exercise work loads and environmental factors. During a computer simulation run, several selected variables are printed at each time step. End conditions are also printed at the completion of the run. G.Y.

N79-25722*# University of Southwestern Louisiana, Lafayette.
A SIMPLE MODEL OF FLUID FLOW AND ELECTROLYTE BALANCE IN THE BODY
Ronald J. White and Larry Neal 24 Jan. 1973 27 p refs Prepared for Gen. Elec. Co., Houston, Tex.
(Contract NAS9-12932)
(NASA-CR-160205; TIR-741-MED-3010) Avail: NTIS HC A03/MF A01 CSCL 06P

The model is basically a three-compartment model, the three compartments being the plasma, interstitial fluid and cellular fluid. Sodium, potassium, chloride and urea are the only major solutes considered explicitly. The control of body water and electrolyte distribution is affected via drinking and hormone levels. Basically, the model follows the effect of various oral input water loads on solute and water distribution throughout the body. G.Y.

N79-25723*# General Electric Co., Houston, Tex. Apollo Systems Dept.
FLUID AND ELECTROLYTE CONTROL SYSTEMS IN THE HUMAN BODY: A STUDY REPORT
Ronald J. White 19 Jun. 1973 13 p refs
(Contract NAS9-12932)
(NASA-CR-160210) Avail: NTIS HC A02/MF A01 CSCL 06P

Research in the area of modeling of the fluid and electrolyte system is briefly reviewed and a model of this system, which is adequate for a basic description of the requisite physiological processes, is presented. The use of this model as an individual subsystem model and as a component of a more complete human model is discussed. Author

N79-25724*# General Electric Co., Houston, Tex.
USER'S INSTRUCTIONS FOR THE HIGH SPEED VERSION OF THE CARDIOVASCULAR EXERCISE MODEL
R. C. Croston 16 Aug. 1973 27 p
(Contract NAS9-12932)
(NASA-CR-160211; TIR-741-MED-3041) Avail: NTIS HC A03/MF A01 CSCL 06B

A mathematical model and digital computer simulation of the human cardiovascular system and its controls were developed to simulate transient responses to bicycle ergometer exercise. The purpose of the model was to provide a method to analyze cardiovascular control hypotheses which cannot be easily tested in an animal or human or in a spaceflight environment. R.E.S.

N79-25725*# General Electric Co., Houston, Tex.
ON A BASIC MODEL OF CIRCULATORY, FLUID, AND ELECTROLYTE REGULATION IN THE HUMAN SYSTEM BASED UPON THE MODEL OF GUYTON
Ronald J. White 23 Aug. 1973 196 p refs
(Contract NAS9-12932)
(NASA-CR-160212; TIR-741-MED-3042) Avail: NTIS HC A09/MF A01 CSCL 06P

A detailed description of Guyton's model and modifications are provided. Also included are descriptions of several typical experiments which the model can simulate to illustrate the model's general utility. A discussion of the problems associated with the interfacing of the model to other models such as respiratory and thermal regulation models which is prime importance since these stimuli are not present in the current model is also included. A user's guide for the operation of the model on the Xerox Sigma 3 computer is provided and two programs are described. A verification plan and procedure for performing experiments is also presented. G.Y.

N79-25726*# Kansas State Univ., Manhattan. Dept. of Electrical Engineering.
INVESTIGATIONS OF RESPIRATORY CONTROL SYSTEMS SIMULATION
R. R. Gallagher 7 Sep. 1973 201 p refs Prepared for GE Co., Houston, Tex.
(Contract NAS9-12932)
(NASA-CR-160213; TIR-741-MED-3047) Avail: NTIS HC A10/MF A01 CSCL 06P

The Grodins' respiratory control model was investigated and it was determined that the following modifications were necessary before the model would be adaptable for current research efforts: (1) the controller equation must be modified to allow for integration of the respiratory system model with other physiological systems; (2) the system must be more closely correlated to the salient physiological functionings; (3) the respiratory frequency and the heart rate should be expanded to illustrate other physiological relationships and dependencies; and (4) the model should be adapted to particular individuals through a better defined set of initial parameter values in addition to relating these parameter values to the desired environmental conditions. Several of Milhorn's respiratory control models were also investigated in hopes of using some of their features as modifications for Grodins' model. R.E.S.

N79-25727*# General Electric Co., Houston, Tex. Space Div.
STUDY REPORT ON MODIFICATION OF THE LONG TERM CIRCULATORY MODEL FOR THE SIMULATION OF BED REST
J. I. Leonard and D. J. Grounds 15 Jul. 1977 114 p refs
(Contract NAS9-14523)
(NASA-CR-160186; TIR-782-LSP-7011) Avail: NTIS HC A06/MF A01 CSCL 06S

Modifications were made of the circulatory, fluid, and electrolyte control model which was based on the model of Guyton. The modifications included separate leg compartments and the addition of gravity dependency. It was found that these modifications allowed for more accurate bed rest simulation by simulating changes in the orthostatic gradient and simulating the response to the fluid shifts associated with bed rest. R.E.S.

N79-25728*# General Electric Co., Houston, Tex.
IMPROVEMENTS AND VALIDATION OF THE ERYTHROPOIESIS CONTROL MODEL FOR BED REST SIMULATION
J. I. Leonard 29 Jul. 1977 90 p refs
(Contract NAS9-14523)
(NASA-CR-160187; TIR-782-LSP-7012) Avail: NTIS

HC A05/MF A01 CSCL 06S

The most significant improvement in the model is the explicit formulation of separate elements representing erythropoietin production and red cell production. Other modifications include bone marrow time-delays, capability to shift oxyhemoglobin affinity and an algorithm for entering experimental data as time-varying driving functions. An area of model development is suggested by applying the model to simulating onset, diagnosis and treatment of a hematologic disorder. Recommendations for further improvements in the model and suggestions for experimental application are also discussed. A detailed analysis of the hematologic response to bed rest including simulation of the recent Baylor Medical College bed rest studies is also presented. G.Y.

N79-25729*# General Electric Co., Houston, Tex.
STUDY REPORT ON INTERFACING MAJOR PHYSIOLOGICAL SUBSYSTEM MODELS: AN APPROACH FOR DEVELOPING A WHOLE-BODY ALGORITHM
D. G. Fitzjerrell, D. J. Grounds, and J. I. Leonard 20 Jun. 1975 113 p refs
(Contract NAS9-12932)
(NASA-CR-160232; TIR-741-MED-5008) Avail: NTIS HC A06/MF A01 CSCL 06P

Using a whole body algorithm simulation model, a wide variety and large number of stresses as well as different stress levels were simulated including environmental disturbances, metabolic changes, and special experimental situations. Simulation of short term stresses resulted in simultaneous and integrated responses from the cardiovascular, respiratory, and thermoregulatory subsystems and the accuracy of a large number of responding variables was verified. The capability of simulating significantly longer responses was demonstrated by validating a four week bed rest study. In this case, the long term subsystem model was found to reproduce many experimentally observed changes in circulatory dynamics, body fluid-electrolyte regulation, and renal function. The value of systems analysis and the selected design approach for developing a whole body algorithm was demonstrated. R.E.S.

N79-25730*# General Electric Co., Houston, Tex.
THE DEVELOPMENT OF A WHOLE-BODY ALGORITHM
Franklin J. Kay 15 Nov. 1973 120 p refs
(Contract NAS9-12932)
(NASA-CR-160214; TIR-741-MED-3058) Avail: NTIS HC A06/MF A01 CSCL 06P

The whole-body algorithm is envisioned as a mathematical model that utilizes human physiology to simulate the behavior of vital body systems. The objective of this model is to determine the response of selected body parameters within these systems to various input perturbations, or stresses. Perturbations of interest are exercise, chemical unbalances, gravitational changes and other abnormal environmental conditions. This model provides for a study of man's physiological response in various space applications, underwater applications, normal and abnormal workloads and environments, and the functioning of the system with physical impairments or decay of functioning components. Many methods or approaches to the development of a whole-body algorithm are considered. Of foremost concern is the determination of the subsystems to be included, the detail of the subsystems and the interaction between the subsystems. G.Y.

N79-25731*# General Electric Co., Houston, Tex.
USER'S INSTRUCTIONS FOR THE GUYTON CIRCULATORY DYNAMICS MODEL USING THE UNIVAC 1110 BATCH AND DEMAND PROCESSING (WITH GRAPHIC CAPABILITIES)
G. T. Archer 28 Feb. 1974 96 p refs
(Contract NAS9-12932)
(NASA-CR-160215; TIR-741-MED-4004) Avail: NTIS HC A05/MF A01 CSCL 06P

The model presents a systems analysis of a human circulatory regulation based almost entirely on experimental data and cumulative present knowledge of the many facets of the circulatory system. The model itself consists of eighteen different major systems that enter into circulatory control. These systems are grouped into sixteen distinct subprograms that are melded together to form the total model. The model develops circulatory and fluid regulation in a simultaneous manner. Thus, the effects of hormonal and autonomic control, electrolyte regulation, and excretory dynamics are all important and are all included in the model. G.Y.

N79-25732*# General Electric Co., Houston, Tex.
USER'S INSTRUCTIONS FOR THE GE CARDIOVASCULAR MODEL TO SIMULATE LBNP AND TILT EXPERIMENTS, WITH GRAPHIC CAPABILITIES
29 Mar. 1974 33 p
(Contract NAS9-12932)
(NASA-CR-160216; TR-741-MED-4008) Avail: NTIS HC A03/MF A01 CSCL 06P

The present form of this cardiovascular model simulates both 1-g and zero-g LBNP (lower body negative pressure) experiments and tilt experiments. In addition, the model simulates LBNP experiments at any body angle. The model is currently accessible on the Univac 1110 Time-Shared System in an interactive operational mode. Model output may be in tabular form and/or graphic form. The graphic capabilities are programmed for the Tektronix 4010 graphics terminal and the Univac 1110. Author

N79-25733*# General Electric Co., Houston, Tex.
EVALUATION OF EXERCISE-RESPIRATORY SYSTEM MODIFICATIONS AND INTEGRATION SCHEMES FOR PHYSIOLOGICAL SYSTEMS
R. R. Gallagher (Kansas State Univ.) 16 Jul. 1974 92 p refs
(Contract NAS9-12932)
(NASA-CR-160223; TIR-741-MED-4018) Avail: NTIS HC A05/MF A01 CSCL 06P

Exercise subroutine modifications are implemented in an exercise-respiratory system model yielding improvement of system response to exercise forcings. A more physiologically desirable respiratory ventilation rate in addition to an improved regulation of arterial gas tensions and cerebral blood flow is observed. A respiratory frequency expression is proposed which would be appropriate as an interfacing element of the respiratory-pulsatile cardiovascular system. Presentation of a circulatory-respiratory system integration scheme along with its computer program listing is given. The integrated system responds to exercise stimulation for both nonstressed and stressed physiological states. Other integration possibilities are discussed with respect to the respiratory, pulsatile cardiovascular, thermoregulatory, and the long-term circulatory systems. Author

N79-25734*# General Electric Co., Houston, Tex.
STUDY REPORT ON GUIDELINES AND TEST PROCEDURES FOR INVESTIGATING STABILITY OF NONLINEAR CARDIOVASCULAR CONTROL SYSTEM MODELS
D. G. Fitzjerrell 11 Nov. 1974 17 p refs
(Contract NAS9-12932)
(NASA-CR-160229; TIR-741-MED-4029) Avail: NTIS HC A01/MF A01 CSCL 06P

A general study of the stability of nonlinear as compared to linear control systems is presented. The analysis is general and, therefore, applies to other types of nonlinear biological control systems as well as the cardiovascular control system models. Both inherent and numerical stability are discussed for corresponding analytical and graphic methods and numerical methods. G.Y.

N79-25735*# General Electric Co., Houston, Tex.
USER'S INSTRUCTIONS FOR THE WHOLE-BODY ALGORITHMS
D. J. Grounds, D. G. Fitzjerrell, J. I. Leonard, and V. J. Marks 24 Jun. 1975 134 p
(Contract NAS9-12932)
(NASA-CR-160233; TIR-741-MED-5009) Avail: NTIS HC A07/MF A01 CSCL 06P

The design of an algorithm that provides for the simulation of long and short term biological stresses is reported. The physiological responses of models representing circulatory, respiratory, cardiovascular, and thermoregulatory systems during space flight simulation are described. M.M.M.

N79-25736*# Pennsylvania State Univ., University Park. Dept. of Biochemistry and Biophysics.
PURIFICATION AND CULTIVATION OF HUMAN PITUITARY GROWTH HORMONE SECRETING CELLS Annual Report

W. C. Hymer 31 May 1979 28 p
(Contract NAS9-15566)
(NASA-CR-160242) Avail: NTIS HC A03/MF A01 CSCL 06A

Efforts were directed towards maintenance of actively secreting human pituitary growth hormone cells (somatotrophs) in vitro. The production of human growth hormone (hGH) by this means would be of benefit for the treatment of certain human hypopituitary diseases such as dwarfism. One of the primary approaches was the testing of agents which may logically be expected to increase hGH release. The progress towards this goal is summarized. Results from preliminary experiments dealing with electrophoresis of pituitary cell for the purpose of somatotroph separation are described. G.Y.

N79-25737*# National Aeronautics and Space Administration. Pasadena Office, Calif.
MULTIFUNCTIONAL TRANSDUCER Patent Application
Cyril Feldstein (JPL), Gilbert W. Lewis (JPL), Virgil H. Culler (JPL), and Samuel Meerbaum, inventors (to NASA) (JPL) Filed 1 Jun. 1979 13 p
(Contract NAS7-100)
(NASA-Case-NPO-14329-1; US-Patent-Appl-SN-044432) Avail: NTIS HC A02/MF A01 CSCL 06B

A transducer is described for simultaneously measuring several parameters of a small region of a muscle tissue or other object, with minimal traumatizing or damage of the object. A trifunctional transducer which can measure the force applied by a muscle fiber, the displacement of the fiber, and the change in thickness of the fiber, includes a device having three legs with the inner ends joined together and outer ends formed to pierce the tissue and lie therein. Two legs are relatively stiff, to measure force applied by the tissue, and a third leg is relatively flexible to measure displacement of the tissue relative to one or both stiff legs, and with the three legs lying in a common plane so that the force and displacement measurements all relate to the same direction of muscle movement. NASA

N79-25738*# General Electric Co., Houston, Tex.
MODIFICATIONS TO THE STEADY-STATE 41-NODE THERMOREGULATORY MODEL INCLUDING VALIDATION OF THE RESPIRATORY AND DIFFUSIONAL WATER LOSS EQUATIONS
17 Jul. 1974 34 p refs
(Contract NAS9-12932)
(NASA-CR-160219; TIR-741-MED-4014) Avail: NTIS HC A03/MF A01 CSCL 06P

After the simplified version of the 41-Node Stolwijk Metabolic Man Model was implemented on the Sigma 3 and UNIVAC 1110 computers in batch mode, it became desirable to make certain revisions. First, the availability of time-sharing terminals makes it possible to provide the capability and flexibility of conversational interaction between user and model. Secondly, recent physiological studies show the need to revise certain parameter values contained in the model. Thirdly, it was desired to make quantitative and accurate predictions of evaporative water loss for humans in an orbiting space station. The result of the first phase of this effort are reported. G.Y.

N79-25739*# General Electric Co., Houston, Tex.
THE APPLICATION OF SYSTEMS ANALYSIS AND MATHEMATICAL MODELS TO THE STUDY OF ERYTHROPOIESIS DURING SPACE FLIGHT
J. I. Leonard 15 Jul. 1974 34 p refs
(Contract NAS9-12932)
(NASA-CR-160218) Avail: NTIS HC A03/MF A01 CSCL 06P

Included in the report are: (1) review of the erythropoietic mechanisms; (2) an evaluation of existing models for the control of erythropoiesis; (3) a computer simulation of the model's response to hypoxia; (4) an hypothesis to explain observed decreases in red blood cell mass during weightlessness; (5) suggestions for further research; and (6) an assessment of the role that systems analysis can play in the Skylab hematological program. G.Y.

N79-25740*# General Electric Co., Houston, Tex. Apollo Systems Dept.
USER'S GUIDE FOR THE SKYLAB INTEGRATED MEDICAL DATA ANALYSIS SYSTEM
D. J. Grounds, G. T. Archer, and V. J. Marks 5 Dec. 1975 96 p refs
(Contract NAS9-14523)
(NASA-CR-160189) Avail: NTIS HC A05/MF A01 CSCL 06P

Capabilities of the Skylab Integrated Medical Data Analysis System (SIMDAS) are described and illustrated. User's instructions are also given for the operation of this system on the UNIVAC 1100 Series Demand System at the Johnson Space Center. Author

N79-25741# Desmatics, Inc., State College, Pa.
SOME BAYESIAN INFERENCE PROCEDURES FOR USE IN DEVELOPING AN IMPACT ACCELERATION INJURY PREDICTION MODEL
John J. Peterson and Dennis E. Smith Mar. 1979 20 p refs
(Contract N00014-74-C-0154; NR Proj. 207-037)
(AD-A067228; TR-102-8) Avail: NTIS HC A02/MF A01 CSCL 12/1

Research on the development of an impact acceleration injury prediction model based primarily on information in the data has been discussed in previous technical reports. This technical report describes Bayesian inference procedures which permit the experimenter to combine his or her prior beliefs and expert knowledge with the data observed in the experiment. Author (GRA)

N79-25742# California Univ., Irvine.
ACUTE TOXICITY OF A NUMBER OF CHEMICALS OF INTEREST TO THE AIR FORCE
C. L. Gaworski, E. R. Kinkead, and R. L. Doyle Mar. 1979 32 p refs
(Contract F33615-76-C-5005; AF Proj. 6302)
(AD-A067313; AMRL-TR-79-11) Avail: NTIS HC A03/MF A01 CSCL 06/20

A series of 20 chemical compounds used by the Air Force were evaluated for acute toxicity effects to establish safe handling guidelines. Skin sensitization potential, irritation effects and LD(50) doses were determined for most of these materials. Of the compounds tested, nonyl phenol caused a skin sensitization reaction in 18 of 20 animals dosed and 1,4-dihydroxyanthraquinone which did not sensitize many animals, produced a very severe reaction in those affected. Author (GRA)

N79-25743# Army Research Inst. of Environmental Medicine, Natick, Mass.
EVIDENCE FOR INCREASED INTRATHORACIC FLUID VOLUME IN MAN AT HIGH ALTITUDE
James J. Jaeger, J. T. Sylvester, A. Cymerman, J. T. Mather, and J. J. Berberich 13 Sep. 1978 27 p
(DA Proj. 3E7-62777-A-845)
(AD-A065333; USARIEM-M-72/78) Avail: NTIS HC A03/MF A01 CSCL 06/5

To determine if subclinical pulmonary edema occurs commonly at high altitude, 25 young male soldiers participated in a strenuous, 72 h field exercise at low altitude (200 to 875 m) and in a similar exercise one week later at high altitude (3000 to 4300 m). At 0, 36, and 72 h of each phase the subjects were given a physical examination, a chest radiograph was taken, and the following measurements were made: total lung capacity, forced vital capacity, residual volume, closing capacity, slope of phase III of the nitrogen washout curve, transthoracic electrical impedance, and the quasi-static relationship between transpulmonary pressure and lung volume (PV curve). GRA

N79-25744# Army Research Inst. of Environmental Medicine, Natick, Mass.
PHYSIOLOGICAL EFFECTS OF A MILITARY TRAINING PROGRAM ON MALES AND FEMALES
William L. Daniels, Dennis M. Kowal, James A. Vogel, and Robert M. Stauffer 28 Jun. 1978 18 p refs
(AD-A062936; USARIEM-M-40/78) Avail: NTIS HC A02/MF A01 CSCL 05/9

The purpose of this study was to determine the effect of a military training program on the aerobic power of young, active males and females. Twenty-nine males and twenty-six females

(17-21 yrs old) were evaluated at the beginning and the end of the six week training which all incoming freshmen (plebes) undergo upon entering the U.S. Military Academy. The aerobic portion of the training consisted of running for 30 minutes, 5-6 days/week. Subjects ran at varied speeds depending upon their performance in an initial 1.5 mile run test. GRA

N79-25745# Army Research Inst. of Environmental Medicine, Natick, Mass.

THE EFFECTS OF DEHYDRATION ON PERIPHERAL COOLING

J. J. Berberich, Donald E. Roberts, and R. E. Roege 18 Jul. 1978 32 p

(AD-A065332; USARIEM-M-2/79) Avail: NTIS HC A03/MF A01 CSCL 06/16

Ten men were dehydrated by voluntary restriction of fluid intake and by mild exercise over a 2 1/2 day period (body weight loss: 4.6%). Body weight returned to -1.6% and -0.3% of their starting weight 10 and 20 hours after rehydration, respectively, suggesting the weight loss was fluid loss. Measures of blood and urine constituents also were supportive of dehydration. These 10 experimental subjects experienced a standard cold test prior to and after dehydration and after rehydration. The standard cold test consisted of sitting in a cold chamber (0 C) dressed in cold weather clothing with right hand bare for 2 hours. The fingers, but not the back of the hand, of the experimentals were significantly (18%) colder following dehydration and were slightly warmer following initial rehydration. A group of 10 control subjects tested under identical conditions, but hydrated at all times, showed no changes. Author (GRA)

N79-25746# Cincinnati Univ., Ohio. Orthopaedic Biomechanics Lab.

KNEE FLAIL DESIGN LIMITS: BACKGROUND, EXPERIMENTATION AND DESIGN CRITERIA Final Report, 1 Mar. 1976 - 15 Jul. 1978

Edward Grood, Frank Noyes, and David Butler Oct. 1978 64 p refs

(Contract F33615-76-C-0511)

(AD-A062384; AMRL-TR-78-58) Avail: NTIS HC A04/MF A01 CSCL 06/5

A major problem experienced during ejection of crewmembers from disabled aircraft is flailing injury to the knee caused by the large aerodynamic forces. The majority of injuries that occur are tears of the collagenous tissues, ligaments and capsular structures, which hold the tibia and femur together at the knee. The design of protective systems capable of preventing these injuries requires knowledge of the mechanical properties of knee ligaments, and the factors which can effect the experimental results. This report combines new experimental data on the tensile strength of human anterior cruciate ligaments and torsional strength of the intact human knee with data on the strength of Rhesus monkey knee ligaments. The information is organized and presented so as to provide a background for relating mechanical property studies of ligaments and tendons to the establishment of design criteria for protective systems. In the last two chapters, the torsional strength data obtained under the current contract are presented and design criteria for the prevention of torsional injuries are developed. The effects of age and species on the tensile strength of the anterior cruciate ligament which were determined in the current contract are presented in greater detail in a separate Air Force technical report.

Author (GRA)

N79-25747# Boeing Co., Seattle, Wash.

THE EFFECTS OF PILOT AGE, LIGHTING, AND HEAD-DOWN TIME ON VISUAL ACCOMODATION

C. Larry and C. Elsworth Feb. 1979 71 p refs

(AD-A064912; D162-10378-1-TN) Avail: NTIS HC A04/MF A01 CSCL 06/16

The study discussed in this report is exploratory. It was undertaken to (1) determine the effects which age, lighting and the duration of near vision tasks have on visual accommodation; and (2) obtain vision data which could be applied to improve aircrew utilization and crew station design. The results indicated that the ability to focus the eyes at infinity following the performance of near vision tasks decreases with age; and eye focusing time is related to the duration of the near vision task, and with some exceptions, increases with increase in near vision task time. Further study, utilizing larger sample sizes, is required to verify these preliminary conclusions and expand their usefulness to crew station designers. Author (GRA)

N79-25748# Army Aeromedical Research Lab., Fort Rucker, Ala.

A PORCINE BIOASSAY STUDY OF THE PHYSIOLOGICAL EFFECTS OF FIBER AND DYE DEGRADATION PRODUCTS (FDP) ON BURN WOUND HEALING Final Report

Francis S. Knox, III, Thomas L. Wachtel, George R. McCahan, Jr., and Stanley C. Knapp Jun. 1978 30 p refs

(DA Proj. 3E7-62173-A-819)

(AD-A066990; USAARL-78-10) Avail: NTIS HC A03/MF A01 CSCL 06/19

Visible components of fiber and dye degradation products were deposited on the surface of burned skin. A single layer of fabric with a 6.35 mm air gap between it and the skin deposited the greatest amount of FDP. The presence of an intervening cotton T-shirt decreased the amount of FDP deposited on the skin. We found no evidence that the FDP caused alterations in wound healing. Author (GRA)

N79-25749# Wayne State Univ., Detroit, Mich. Bioengineering Center.

TOLERANCE OF THE NECK TO INDIRECT IMPACT

Albert I. King, Said S. Nakhla, and Naveen K. Mital 5 Mar. 1979 16 p refs Submitted for publication

(Contract N00014-75-C-1015)

(AD-A066971; TR-10) Avail: NTIS HC A02/MF A01 CSCL 12/1

A two-dimensional mathematical model of the spine was exercised to identify mechanisms of neck injury due to hyperflexion. Loss of pilots due to ditching at sea was one of the motivations for this study. It was found that helmets have the potential of increasing injury severity particularly during a combined -Gz and -Gx impact, with the pulses coincident in time. The four parameters that are potentially injurious are neck shear, chin-chest contact force, odontoid process excursion into the spinal canal and spinal cord stretch. Author (GRA)

N79-25750# Office of Radiation Programs, Las Vegas, Nev. Electromagnetic Radiation Analysis Branch.

MEASUREMENTS OF RADIOFREQUENCY FIELD INTENSITY IN BUILDINGS WITH CLOSE PROXIMITY TO BROADCAST STATIONS

Richard A. Tell and Norbert N. Hankin Aug. 1978 47 p refs

(PB-290944/8; ORP/EAD-78/3) Avail: NTIS HC A03/MF A01 CSCL 06R

The results of a series of radiofrequency field intensity measurements made in eight tall buildings located in New York, Miami, Chicago, San Diego, and Houston are summarized. The buildings in which the measurements were made were selected because of their proximity to FM radio and/or VHF and UHF television transmitting antennas. These broadcast antennas were usually located on nearby buildings so that the possibility existed for high intensity illumination of the upper floors of the buildings selected by the main beam of radiation of the antennas. The principal objective in conducting these measurements was to obtain information about the field intensities which can be produced by broadcast antennas at locations close to the antennas and near the main beam axis. In addition, the measurements help in determining the higher level radiofrequency exposures of persons who work and live in tall buildings under similar irradiation situations. GRA

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N79-25751# Civil Aeromedical Inst., Oklahoma City, Okla.

A COMPARISON OF THREE MODELS FOR DETERMINING TEST FAIRNESS

Mary A. Lewis Nov. 1978 16 p refs

(AD-A066586; FAA-AM-79-3) Avail: NTIS HC A02/MF A01 CSCL 05/10

In addressing the issue of test fairness, the sample size of the minority group is usually very small. Thus, sampling error alone could cause a test to appear unfair to either group, when in fact both groups were sampled from populations with identical test and criterion characteristics. There are three prominent models of test fairness in the dichotomous situation: (1) Thorndike's Constant Ration model; (2) Darlington's Conditional Probability model; and (3) Einhorn and Bass's Equal Probability model. Using a Monte Carlo technique, the robustness of these models to divergent sample size were explored. The models were compared for their robustness to sample size differences, different predictor/criterion correlations and different selection and success ratios. Results indicate that all three models are equally able to identify test fairness under the conditions specified in the study. G.Y.

N79-25752# Civil Aeromedical Inst., Oklahoma City, Okla.
THE DEVELOPMENT OF THE ATC SELECTION BATTERY: A NEW PROCEDURE TO MAKE MAXIMUM USE OF AVAILABLE INFORMATION WHEN CORRECTING CORRELATIONS FOR RESTRICTION IN RANGE DUE TO SELECTION
James O. Boone and Mary A. Lewis Sep. 1978 46 p refs (FAA-AM-78-36) Avail: NTIS HC A03/MF A01

A five-test selection battery is currently given to select air traffic controllers. Data were collected on two tests being considered for incorporation into the battery. To determine the utility of the old and new tests, it is necessary to correlate the tests with a criterion of job success. However, since criterion information is available only on persons already selected for air traffic control work, the correlation is restricted to this upper range of persons, and is, thereby, spuriously low for prediction purposes. To properly evaluate the utility of the tests, the correlation must be corrected for this restriction in range. A procedure to more accurately correct correlations for restriction in range is described. G.Y.

N79-25753*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OVERALL LOUDNESS OF STEADY SOUNDS ACCORDING TO THEORY AND EXPERIMENT
Walton L. Howes Oct. 1979 150 p refs
(NASA-RP-1001; E-8342) Avail: NTIS MF A01; HC SOD CSCL 05J

A mathematical theory for calculating the loudness of any steady sound from information on its spectrum is constructed from physical principles and psychological and physiological information on mammalian auditory systems. The theory involves filtering, channeling, squaring, half-wave rectification, and time average of the signal. The theory accounts for critical bands for loudness, audibility of sounds consisting of subliminal components, audible beats, periodicity pitch, and pitch of the residue. These and other pyschoacoustic phenomena are explained in terms of electrical activity in the peripheral nervous system. Simple approximations for loudness are derived from the more exact formulas. Loudness predictions are compared with a wide variety of published loudness judgement data with considerable success. Author

N79-25754# Catholic Univ. of America, Washington, D. C. Dept. of Psychology.
TWO APPROACHES TO CATEGORY REPRESENTATION IN AURAL CLASSIFICATION
James A. Ballas and James H. Howard, Jr. Dec. 1978 24 p refs
(Contract N00014-75-C-0308)
(AD-A066705; TR-78-9-ONR) Avail: NTIS HC A02/MF A01 CSCL 06/16

The classification model proposed by Howard, Ballas and Burgy (1978) assumes that each category in a classification task is represented by an abstract prototype. Neumann (1977) argues that the evidence for prototype representations can be explained by the indeterminancy of examplar attributes. A test of these two models would require that attribute indeterminancy be measured. In a classification task, attribute indeterminancy can lead to overlapping category boundaries. In turn, this results in confusions, which can then be a measure of indeterminancy. An aural classification experiment was conducted where listeners classified sixteen amplitude-modulated noise patterns into one of four, four-examplar categories. Results of a post training recognition test indicated that an unexperienced prototype was rated as familiar, but this effect was reduced with increased practice with the category examplars. Neither the prototype nor Neumann's model was supported unequivocally. Classification results did demonstrate that the classification model is applicable to four examplar categories defined in two dimensions. Author (GRA)

N79-25755# Catholic Univ. of America, Washington, D. C. Human Performance Lab.
PREDICTING INDIVIDUAL LISTENER CONFUSIONS IN THE CLASSIFICATION OF COMPLEX, STEADY-STATE SOUNDS
James A. Ballas and James H. Howard, Jr. Dec. 1978 24 p refs
(Contract N00014-75-C-0308)
(AD-A066704; TR-78-8-ONR) Avail: NTIS HC A02/MF A01 CSCL 06/6

Research was conducted using amplitude modulated noise with modulation frequency and waveform attack as relevant dimensions. Subjects were required to classify sixteen sounds into eight categories emphasizing one of the dimensions for eight blocks and then the other dimension for eight blocks. Capacity was estimated by the model and was equivalent for both classification tasks for individual subjects. Allocation of capacity reflected dimensional relevance. M.M.M.

N79-25756# Catholic Univ. of America, Washington, D. C. Dept. of Psychology.
CLASSIFICATION OF AMPLITUDE-MODULATED NOISE PATTERNS WITH EXTENDED PRACTICE
James H. Howard, Jr. and James A. Ballas Dec. 1978 23 p refs
(Contract N00014-75-C-0308)
(AD-A066703; TR-78-7-ONR) Avail: NTIS HC A02/MF A01 CSCL 06/16

Four listeners were given extended practice in an eight-category classification task (3072 trials). The stimuli were sixteen amplitude-modulated noise patterns that varied in modulation frequency (Tempo) and attack (Quality). Two listeners learned an eight-category partition that was based primarily on stimulus Quality, and two learned a partition that was based primarily on stimulus Tempo. The resulting confusion data were analyzed in terms of the aural classification model proposed by Howard, Ballas, and Burgy (1978). The theoretical analysis enabled us to specify the relative emphasis placed on the two stimulus features by each listener on each of the sixteen trial blocks. The results indicated that although large individual differences occurred, all listeners had more difficulty making use of the subtle stimulus differences along the Quality dimension than they did of differences along the Tempo dimension. GRA

N79-25757# Arizona State Univ., Tempe.
STRESS AND SIMULATION IN PILOT TRAINING Final Report, May - Dec. 1977
Gary S. Krahenbull Feb. 1979 26 p refs
(Contract F41609-75-C-0028)
(AD-A066670; AFHRL-TR-78-95) Avail: NTIS HC A03/MF A01 CSCL 05/9

Catecholemine excretion for 20 USAF student pilots and 13 instructor pilots was determined during daily activities, during sorties performed in high realism simulators, and during actual flight. High realism simulation resulted in a measurable stress response in both students and instructors; the response was not related to previous flight experience. One group of students (experimental, n-10) experienced power-on stalls and spin recoveries in the simulator prior to their introduction in the aircraft. A second group of students (control, n-10) experienced power-on stalls and spin recoveries in the aircraft prior to their introduction in the simulator. Catecholamine excretion during simulation was not different for the two groups, thus aircraft exposure to the spin series did not alter the stress response of the students attempting a similar maneuver in a high realism simulator. Catecholamine excretion during the aircraft spin was also similar

for the experimental and control groups; however, the relative proportions of epinephrine and norepinephrine were different for the experimental and control groups. Thus, task-specific high realism simulation introduced prior to exposure to related stressful in-flight tasks results in similar total stress response, but somewhat lower arousal and greater mental activity. A comparison of superior and inferior students within each groups suggested that the simulator pretraining had the greatest effect on the inferior students. A comparison of student and instructor catecholamine excretion from the aircraft power-on stall and spin recovery lesson unit showed a lack of significant relationship. GRA

N79-25758# National Technical Information Service, Springfield, Va.
FLIGHT SIMULATOR TRAINING, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1974 - Feb. 1979
Guy E. Habercom, Jr. Apr. 1979 229 p Supersedes NTIS/PS-78/0128; NTIS/PS-77/0146; NTIS/PS-76/0068 (NTIS/PS-79/0277/8; NTIS/PS-78/0128; NTIS/PS-77/0146; NTIS/PS-76/0068) Avail: NTIS HC $28.00/MF $28.00 CSCL 05I

Volume two continues the materials begun in Volume one. Documentation is presented of methodology and equipment used in the training of airmen, principally military, involving flight simulation and simulators. Subjects of discussion include maneuvering, visual fields, visual perception, flight control, guidance, approach, landings, VTOL and STOL craft, helicopters, pilot characteristics, performance standards, space flight, and aircraft dynamics. Also covered are training concepts, physiological characteristics, and psychological aspects. References on the training simulators themselves, but not on their use, are excluded. GRA

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N79-25759*# General Electric Co., Houston, Tex.
THE APPLICATION OF MINIQUASI TO THERMAL PROGRAM BOUNDARY AND INITIAL VALUE PROBLEMS
7 Oct. 1974 8 p refs
(Contract NAS9-12932)
(NASA-CR-160227; TIR-741-MED-4026) Avail: NTIS HC A02/MF A01 CSCL 06P

The feasibility of applying the solution techniques of Miniquasi to the set of equations which govern a thermoregulatory model is investigated. For solving nonlinear equations and/or boundary conditions, a Taylor Series expansion is required for linearization of both equations and boundary conditions. The solutions are iterative and in each iteration, a problem like the linear case is solved. It is shown that Miniquasi cannot be applied to the thermoregulatory model as originally planned. G.Y.

N79-25760*# Hamilton Standard, Windsor Locks, Conn.
FLIGHT PROTOTYPE CO2 AND HUMIDITY CONTROL SYSTEM Final Report
Karen M. Rudy May 1979 79 p
(Contract NAS9-13624)
(NASA-CR-160224; SVHSER-7208-Add) Avail: NTIS HC A05/MF A01 CSCL 06K

A regenerable CO2 and humidity control system is presently being developed for potential use on shuttle as an alternative to the baseline lithium hydroxide system. The system utilizes a sorbent material (designated HS-C) to adsorb CO2 and the latent heat load from the cabin atmosphere and desorb the CO2 and water vapor overboard when exposed to a space vacuum, thus reducing the overall vehicle heat rejection load. Continuous operation is achieved by utilizing two beds which are alternatively cycled between adsorption and desorption. The HS-C material process was verified. Design concepts for the auxiliary components for the HS-C prototype system were generated. Performance testing verified system effectiveness in controlling CO2 partial pressure and humidity. Author

N79-25761*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
HELMET WEIGHT SIMULATOR Patent Application
Billy R. Ashworth, Alton C. Hall, and Clyde E. Clark, inventors (to NASA) Filed 30 May 1979 9 p
(NASA-Case-LAR-12320-1; US-Patent-Appl-SN-043913) Avail: NTIS HC A02/MF A01 CSCL 01D

A device for providing acceleration cues to the helmet of a simulator pilot is presented. Pulleys are attached to both shoulders of the pilot. A cable is attached to both sides of the helmet and extends through the pulleys to a takeup reel that is controlled by a torque motor. Control signals are applied to a servo system including the torque motor, the takeup reel and a force transducer which supplies the feedback signal. In one embodiment of the invention the force transducer is in the cable and in another it is in the takeup reel. NASA

N79-25762# Army Aeromedical Research Lab., Fort Rucker, Ala.
EVALUATION OF FOUR THERMALLY PROTECTIVE FABRICS USING THE USAARL BIOASSAY METHOD Final Report
Francis S. Knox, III, Thomas L. Wachtel, and George R. McCahan, Jr. Jun. 1978 36 p refs Presented at the 10th Sci. and Session of the Joint Comm. on Aviation Pathol., Halton, Engl., Sep. 1976
(DA Proj. 3E7-62773-A-819)
(AD-A067351; USAARL-78-9) Avail: NTIS HC A03/MF A01 CSCL 11/5

The United States Army Aeromedical Research Laboratory (USAARL) porcine cutaneous bioassay technique was used to determine what mitigating effect four thermally protective flight suit fabrics would have on fire-induced skin damage. The fabrics were 4.8 oz. twill weave Nomex aramide, 4.5 oz. stabilized twill weave polybenzimidazole, a 4.8 oz. plain weave experimental high temperature polymer, and 4.8 oz. plain weave Nomex aramide. Each fabric sample was assayed 20 times in each of four configurations: as a single layer in contact with the skin; as a single layer with a 6.35 mm (one-fourth inch) air gap between fabric and skin; in conjunction with a cotton T-shirt with no air gaps; and, finally, in conjunction with a T-shirt with 6.35 mm air gap between T-shirt and fabric. Bare skin was used as a control. A JP-4 fueled furnace was used as a thermal source and was adjusted to deliver a mean heat flux of 3.07 sq cm sec. The duration of exposure was five seconds. Four hundred burn sites were graded using clinical observation and microscopic technique. GRA

N79-25763# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio. School of Engineering.
AN ADAPTIVE CONTROLLER WHICH DISPLAYS HUMAN OPERATOR LIMITATIONS FOR A FIGHTER TYPE AIRCRAFT Ph.D. Thesis
Eric K. Lindberg Nov. 1978 306 p refs
(AD-A066193; AFIT/DS/EE/78-1) Avail: NTIS HC A14/MF A01 CSCL 01/3

A general adaptive controller which displays human operation limitations is developed for a fighter type aircraft flying a dynamic trajectory by using the total airframe-control system perturbation equations. The adaptive controller is implemented using a forced separation controller with limitations. The major limitations are that it cannot actively control or observe more than one channel at a time and that there is a time delay in information processing. A decision process is necessary to choose the current channel in real-time because of the limited attention and control assumed for the controller. This attention has two effects: specification of an observation matrix, and specification of a control matrix. This specification is made using a Bayesian decision process, from a choice of possible observations and controls, each choice emphasizing different aircraft states. The mathematical outcome is an adaptive forced separation controller which is flexible enough that it can be implemented on any aircraft control problem as long as the trajectory can be specified. Analysis and synthesis techniques for the time varying aircraft model dynamics are demonstrated. The outcome is the evolution of a

method for analyzing total aircraft/controller response to perturbations on a general trajectory. GRA

N79-25764# Navy Clothing and Textile Research Facility, Natick, Mass.
ALUMINIZED FIREFIGHTERS' CRASH-RESCUE PROTECTIVE HOOD: FACEPIECE-VISOR REDESIGN STUDY Final Report, Oct. 1976 - Sep. 1977
Francis S. Andruk Dec. 1978 16 p refs
(AD-A066492; NCTRF-134; CEEDO-TR-78-04) Avail: NTIS HC A02/MF A01 CSCL 06/17

The Navy Clothing and Textile Research Facility (NCTRF) conducted a redesign study for the purpose of improving the standard aluminized firefighters: crash-rescue hood. Efforts were directed towards developing an adjustable facepiece visor assembly, which would permit unrestricted visibility, verbal communication, and the exchange of fresh air during standby situations. An adjustable configuration was conceived and initial samples of a comparable commercial type were fabricated and subjected to a limited performance test. Results showed this type to be highly functional; however, under fire emergency conditions, several areas proved to be marginal or inadequate. To eliminate these problem areas, NCTRF modified the facepiece design. As the required task approached a resolution, the fiscal year ended and the program terminated. Because the need still exists for an improved hood, appropriation of additional funds and continuance of this redesign study is recommended. GRA

N79-25765# Navy Clothing and Textile Research Facility, Natick, Mass.
FIELD EVALUATION OF EXPERIMENTAL CRASH-CREW FIREFIGHTER'S FACEPIECE Final Report, Oct. 1976 - Sep. 1977
Norman F. Audet Dec. 1978 47 p refs
(AD-A066544; NCTRF-135) Avail: NTIS HC A03/MF A01 CSCL 06/17

The Navy Clothing and Textile Research Facility (NCTRF) under the sponsorship of the Civil and Environmental Engineering Develoment Office (CEEDO), Detachment 1 ADTC, Tyndall Air Force Base, conducted a field evaluation of an Abcite-over-coated experimental crash-crew firefighter's gold facepiece to determine if the experimental facepiece was more durable than the standard item. Laboratory results had previously shown the experimental facepiece to have at least 10 times better abrasion resistance than the standard. Author (GRA)

N79-25766# Army Aeromedical Research Lab., Fort Rucker, Ala.
MATHEMATICAL MODELS OF SKIN BURNS INDUCED BY SIMULATED POSTCRASH FIRES AS AIDS IN THERMAL PROTECTIVE CLOTHING DESIGN AND SELECTION Final Report
Francis S. Knox, III, Thomas L. Wachtel, and Stanley C. Knapp Jun. 1978 32 p refs Submitted for publication
(DA Proj. 3E7-62173-A-819)
(AD-A066946; USAARL-78-15) Avail: NTIS HC A03/MF A01 CSCL 12/1

The design and selection of thermal protective clothing takes into account many factors, e.g., appearance, comfort, durability, cost, and thermal protective capability. To aid in determining the appropriate balance among these factors, thermal protective capability must be measured in a quantitative and clinically meaningful way. To provide such a valid assessment of thermal protective capability, two mathematical models were developed to predict skin burn damage based on data derived from 95 domestic white pigs exposed to simulated postcrash fires. The first model, a multidiscriminate statistical model derived from experimental data, was used to determine the importance of many variables, e.g., incident heat flux, exposure time, initial skin temperature, and color of the skin. The second, an analytical model, assumes that tissue damage proceeds as a first order chemical reaction dependent on tissue temperature, and that total damage is merely the time integral of tissue damage during heating and cooling. It also takes into account tissue water boiling and thermal shrinkage which alter burn depth in more severe burns. The predicted burn depths from measurements of thermal energy transfer through or emanating from burning fabrics when combined with burn area, age, and sex yield predicted survivability. Predictions of changes in survivability allow rational judgments to be made regarding the effectiveness of implementing proposed flight suit clothing fabric and design changes. GRA

N79-25983# Mitre Corp., McLean, Va.
IMPROVEMENTS IN THE MAN-MACHINE INTERFACE FOR DATA ACQUISITION, DISPLAY AND CONTROL
Warren A. Manison *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 14 p refs (For primary document see N79-25977 16-99)
Avail: NTIS HC A16/MF A01

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering*.

N79-25767 State Univ. of New York at Buffalo.
OPTIMAL SCHEDULING OF TASK GROUPS ON TIGHTLY COUPLED MULTIPROCESSORS Ph.D. Thesis
Leslie Jill Miller 1979 161 p
Avail: Univ. Microfilms Order No. 7913909

A Single Architecture Heterogeneous Multiprocessor (SAHM) to consist of several different processors with the same instruction set was defined. For any fixed task load in the different task groups an algorithm is given for deciding how much of each task group should be executed by each processor, so as to minimize total execution time. The model assumes that task loads are continous and the optimal solution is found by linear programming techniques. The optimal results of this static scheduling model as parameters for a more realistic dynamic scheduling model are presented. Results show how different task groups can be effectively scheduled on any homogeneous or heterogenous multiprocessor by fairly straightforward extensions of the techniques developed for the SAHM model.
Dissert. Abstr.

N79-25768 Carnegie-Mellon Univ., Pittsburgh, Pa.
THE SWITCHING STRUCTURE AND ADDRESSING ARCHITECTURE OF AN EXTENSIBLE MULTIPROCESSOR: Cm* Ph.D. Thesis
Richard James Swan 1978 244 p
Avail: Univ. Microfilms Order No. 7911937

Motivations are given for the switching structure and numerous techniques used to allow a high performance, cost-effective, deadlock free, switch realization are described for a system to support 10,000 processors. A model is presented which allows the systematic analysis and comparison of addressing architectures. The creation of an independent addressing environment when each subprogram is invoked (as in HYDRA

and FAMOS) is compared to process-based addressing (as used in Multics and CAP). It is shown that independent addressing environments for each subprogram allows greater flexibility in the time of name binding, have fewer levels of indirection, and are better suited to multiprocessor systems. Dissert. Abstr.

N79-25769 Carnegie-Mellon Univ., Pittsburgh, Pa.
PERFORMANCE EVALUATION OF MULTIPLE PROCESSOR SYSTEMS Ph.D. Thesis
Levy Raskin 1978 235 p
Avail: Univ. Microfilms Order No. 7911934

A multiprocessor with shared memory and a local computer network in which all communication is via messages were investigated. Results are derived both from running benchmark applications and from performance models. The relative performance, and performance issues, involved in comparing the multiprocessor performance to the local network performance, are discussed and the advantages of using the shared address space in multiprocessors is shown. The design space attributes that mainly affect performance of local network structures are described. The possibility of forming an optimal match between application programs and multiple processor structures was examined. Dissert. Abstr.

N79-25770 Carnegie-Mellon Univ., Pittsburgh, Pa.
DESIGN OF ADAPTIVE ALGORITHMS FOR MICROCOMPUTER PROCESS CONTROL Ph.D. Thesis
Carlos Sixto Baradello 1978 468 p
Avail: Univ. Microfilms Order No. 7911920

The design, simulation experimentation, and microcomputer implementation of adaptive controllers are presented for process control applications. Simulation experiments are conducted with the controller. The controller requires advanced knowledge of the desired behavior of the process output. This information is provided either by computing the output of the reference model in advance or by specifying a realizable trajectory. Two alternative adaptive controllers are investigated: the first inverts the identifier model and the second identifies the inverse of the process model. A prototype of an identifier and controller on-a-chip is designed for implementation on a MDS-800 microcomputer development system based in the Intel 8080-A microprocessor. Dissert. Abstr.

N79-25771*# General Electric Co., Houston, Tex.
DESIGN SPECIFICATION FOR A GENERAL PURPOSE DATA INTEGRATION AND DISPLAY SYSTEM (DIDS)
12 Feb. 1973 82 p
(Contract NAS9-12932)
(NASA-CR-160207; TIR-741-MED-3016) Avail: NTIS HC A05/MF A01 CSCL 09B

The capability for any program written in FORTRAN or XSYMBOL to display its output is provided. Displays are presented on the Biomed Console CRT, the COMPLOT X-Y plotter or both. The display of data stored on magnetic tape is accomplished without the necessity of coding a program. The keyboard on the Biomed Console or the teletype was designed to be the user's interface with DIDS to call displays stored on magnetic tape. S.E.S.

N79-25772*# Sperry Univac, St. Paul, Minn. Defense Systems Div.
DEVELOPMENT OF NON-VOLATILE SEMICONDUCTOR MEMORY Final Report
W. W. Heikkila 16 Mar. 1979 100 p refs
(Contract NAS9-14881)
(NASA-CR-160167; PX-75000-282) Avail: NTIS HC A05/MF A01 CSCL 09B

A 256 word by 8-bit random access memory chip was developed utilizing p channel, metal gate metal-nitride-oxide-silicon (MNOS) technology; with operational characteristics of a 2.5 microsecond read cycle, a 6.0 microsecond write cycle, 800 milliwatts of power dissipation; and retention characteristics of 10 to the 8th power read cycles before data refresh and 5000 hours of no power retention. Design changes were implemented to reduce switching currents that caused parasitic bipolar transistors inherent in the MNOS structure to turn on. Final wafer runs exhibited acceptable yields for a die 250 mils on a side. Evaluation testing was performed on the device in order to determine the maturity of the device. A fixed gate breakdown mechanism was found when operated continuously at high temperature. R.E.S.

N79-25773*# Harris Corp., Melbourne, Fla. Electro-Optics Dept.
HOLOMEM, OPTICAL MASS MEMORY INVESTIGATIONS, VOLUME 1 Final Report
H. N. Roberts Jun. 1977 364 p refs
(Contract NAS8-30564)
(NASA-CR-158625) Avail: NTIS HC A16/MF A01 CSCL 09B

Research and design activities in support of the development of a 10 to the 12th power-bit holographic read/write optical mass memory (HOLOMEM) with some moving parts for space applications are summarized. The report consists of four sections: (1) a general introduction, which includes a summary of key accomplishments and the principal conclusions of the study; (2) a comprehensive analysis of alternative HOLOMEM system concepts; (3) a discussion of important design and tradeoff considerations related to the fabrication, test, and evaluation of a breadboard holographic recorder/reproducer; and (4) a summary of experimental data generated to define the holographic recording performance of two quasi-commercial photoplastic recording films. G.Y.

N79-25774*# Harris Corp., Melbourne, Fla. Electro-Optics Dept.
DIGIMEN, OPTICAL MASS MEMORY INVESTIGATIONS, VOLUME 2 Final Report
Jun. 1977 175 p refs
(Contract NAS8-30564)
(NASA-CR-158626) Avail: NTIS HC A08/MF A01 CSCL 09B

The DIGIMEM phase of the Optical Mass Memory Investigation Program addressed problems related to the analysis, design, and implementation of a direct digital optical recorder/reproducer. Effort was placed on developing an operational archival mass storage system to support one or more key NASA missions. The primary activity of the DIGIMEM program phase was the design, fabrication, and test and evaluation of a breadboard digital optical recorder/reproducer. Starting with technology and subsystem perfected during the HOLOMEM program phase, a fully operational optical spot recording breadboard that met or exceeded all program goals was evaluated. A thorough evaluation of several high resolution electrophotographic recording films was performed and a preliminary data base management/end user requirements survey was completed. G.Y.

N79-25775# Committee on Science and Technology (U. S. House).
COMPUTERS AND THE LEARNING SOCIETY
Washington GPO 1978 700 p refs Hearings before the Subcomm. on Domestic and Intern. Scientific Planning, Analysis and Cooperation of the Comm. on Sci. and Technol., 95th Congr., 1st Sess., 4, 6, 12-13, 18 and 27 Oct. 1977
(GPO-23-082) Avail: Subcomm. on Domestic and Intern. Scientific Planning, Analysis and Cooperation

The utilization and impact of computer technology on various modes of learning in American society are discussed in an attempt to identify approaches to improve the quality of the nation's educational process. Topics covered include the successful application of computer management in a school district; three major computer-assisted instructional systems currently marketed commercially; findings and directions of current research development; comments of representatives from federal agencies on issues examined; and the role of computers in aiding the education of handicapped persons. A.R.H.

N79-25776# SRI International Corp., Menlo Park, Calif.
M-MODULES: A DESIGN METHODOLOGY
Marshall C. Pease Mar. 1979 48 p refs
(Contract N00014-77-C-0308)
(AD-A067303; SRI-TR-17) Avail: NTIS HC A03/MF A01 CSCL 09/2

The theory of what we call M-modules for model-driven modules is developed. An M-module is a knowledge-based program module in which the knowledge is encoded as a model that remains available for modification or adaption to meet

changing requirements. The methodology of M-modules can help the system designer to make effective use of the decomposition properties of a complex problem. It helps him to decompose an application problem into a hierarchy of subproblems that are much more easily understood and managed by a human user. An important feature that makes the decomposition useful is the methodology orders system operations in a way that prevents deadlock and that contributes to avoiding other system malfunctions. An M-module contains three components: a model, a set of values, and a set of procedures. The model encodes knowledge about the domain that is the responsibility of the M-module. The set of values describes the M-module's current information about that domain to the level of detail relevant to the M-module. The procedures are those necessary to modify or retrieve information contained in the set of values or to modify or retrieve the model of the procedures. The M-module accepts information or demands from outside itself--either from a user or from another M-module--and responds according to its internal condition and the constraints of its model. A key aspect of M-modules is that it leads to a hierarchical system design.
GRA

N79-25777# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
EQUIVALENCE PROPERTIES OF SEMANTIC DATA MODELS FOR DATABASE SYSTEMS Ph.D. Thesis
Sheldon A. Borkin Jan. 1979 315 p refs
(Contract N00014-75-C-0661)
(AD-A066386; MIT/LCS/TR-206) Avail: NTIS HC A14/MF A01 CSCL 05/2

A data model defines the types of structures present in a database and the types of operations which may be used to alter the database. An understanding of data model equivalence properties is necessary if one wishes to implement a system which presents different uses with views of a database in terms of differing data models or which provides a common interface to several database systems defined in terms of different data models. Requisites for this understanding are formal definitions of the involved concepts and a formal framework in which different data models can be compared. This thesis presents formal definitions of the terms database, operation, operation type, application model. Database state equivalence, operation equivalence, application model equivalence and data model equivalence are distinguished. Three types of application and data model equivalence are defined - isomorphic, composed operation and state dependent. Implementation implications of these different equivalences are discussed. It is proved that the semantic graph and the restricted semantic relation data models are state dependent equivalent. Observations on the network vs. relational data model 'controversy' are presented. Suggestions for applications of this research include a dual semantic data model interface.
GRA

N79-25778# Rome Air Development Center, Griffiss AFB, N.Y.
A DATA BASE MANAGEMENT MODELING TECHNIQUE AND SPECIAL FUNCTION HARDWARE ARCHITECTURE
Gerard T. Capraro and P. Bruce Berra Jan. 1979 263 p refs
(AF Proj. 2338)
(AD-A066722; RADC-TR-79-14) Avail: NTIS HC A12/MF A01 CSCL 09/2

This research is concerned with the development of a mathematical base that can be utilized to model data base management systems from the user level down to the bit level and to develop and evaluate proposed hardware that could be utilized to implement a data dictionary and part of a data directory. The mathematical modeling development is accomplished through set theory and the addition of order to sets. This mathematical base is used to define in detail some of the functions that must be performed in Data Base Management (DBM) by operating on the following four levels of data: (1) the user computer interface (Reserved Word); (2) the attribute and file or relationship (F/R) names (Data Name); (3) the modifiers of the attribute and F/R names (Data Descriptors); and (4) the occurrences of the attributes and F/Rs (Data occurrence). Hardware implementation designs are then considered for a subset of these functions and data levels. The data levels considered are the Data Name and Data Descriptor Levels. Specifically, hardware designs are developed for the data and functions performed by a Data Dictionary and parts of a Data Directory. Given the proposed hardware implementation the final step in this research is to evaluate this hardware by comparing its processing times with the processing times for a conventional sequential computer.
GRA

N79-25779# Electronics Research Lab., Adelaide (Australia).
A SELECTIVE DATASET BACKUP SCHEME FOR THE DRCS CENTRAL COMPUTER
J. C. Gwatking Jul. 1978 41 p refs
(AD-A066535; ERL-0021-TR) Avail: NTIS HC A03/MF A01 CSCL 09/2

This report describes the approach taken by the DRCS Computing Centre to maintaining adequate backup facilities while the quantity of data stored on-line continues to increase. The aim is to provide the required level of service to users with minimum operational overhead. This has been accomplished by the development of a software system to control the backup process. The basis of this scheme is the ability to determine which datasets have been altered and to select only these for backup.
Author (GRA)

N79-25780# Pennsylvania Univ., Philadelphia. Dept. of Decision Sciences.
EXPLORING THE CONCEPT OF A CODASYL DATABASE MACHINE
Richard D. Hackathorn Jan. 1979 34 p refs
(Contract N00014-75-C-0440)
(AD-A067249; Rept-78-12-04) Avail: NTIS HC A03/MF A01 CSCL 09/2

This paper explores the concept of a database machine using the approach of the CODASYL data model. A database machine is defined as an integration of hardware and software for providing generalized database management capability in a physically separate device. The advantages of a database machine, along with functional specifications, are presented. Next, an illustration of using a database machine is given through an example of invoice processing using the SEED database management system on a DECsystem-10 computer. Finally, the implications of several design alternatives arising from the illustration are discussed.
Author (GRA)

N79-25781# Maryland Univ., College Park. Dept. of Aerospace Engineering
STRUCTURAL MATHEMATICS MODELING Final Report
Harry Schaeffer 16 Mar. 1979 7 p
(Contract N00014-75-C-0902; RR0230301; NR Proj. 064-544)
(AD-A066743) Avail: NTIS HC A02/MF A01 CSCL 09/2

The purpose of this study is to evaluate the potential of microcomputers for supporting engineering analysis. The story was motivated by the introduction of low-cost microcomputers and associated peripheral equipment.
Author (GRA)

N79-25109*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PRELIMINARY MAINTENANCE EXPERIENCE FOR DSS 13 UNATTENDED OPERATIONS DEMONSTRATION
D. S. Remer and G. Lorden (California Institute of Technology) *In its* the Deep Space Network 15 Jun. 1979 p 150-161 refs (For primary document see N79-25088 16-12)
Avail: NTIS HC A11/MF A01 CSCL 09B

N79-25995# Rome Air Development Center, Griffiss AFB, N.Y.
DATA PROCESSING OPPORTUNITIES 1980 - 1990
Alan R. Barnum *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 8 p refs (For primary document see N79-25977 16-99)
Avail: NTIS HC A16/MF A01

N79-25998# Admiralty Surface Weapons Establishment, Portsmouth (England).
WORKING WITH TECHNOLOGY: DISTRIBUTED PROCESSING STANDARDS FOR THE EIGHTIES
B. R. Glaman, K. Jackson (Royal Signals and Radar Establishment, Malvern, England), R. C. Makin, D. Nairn, R. S. Newton (Royal Signals and Radar Establishment, Malvern, England), and T. D. Wells *In* AGARD Tech. for Data Handling in Tactical Systems,

2 Apr. 1979 11 p (For primary document see N79-25977 16-99)
Copyright. Avail: NTIS HC A16/MF A01

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N79-25782 Boston Univ., Mass.
DEBUGGING LISP PROGRAMS Ph.D. Thesis
Lorne H. Bouchard 1979 293 p
Avail: Univ. Microfilms Order No. 7912126

The technique of extended interpretation is applied to the problem of debugging simple iterative and recursive programs written in a subset of LISP. The debugging task is divided into two distinct phases, the syntactic and semantic phase. Each phase is handled by program of system written in LISP. The overall syntax of a proposed program is checked by the syntax system. Type checking, type characterization, and convergence analysis is performed by the semantic system. Some of the uses of these tools in automatic program debugging are discussed. Dissert. Abstr.

N79-25783 Washington Univ., Seattle.
THE THEORY OF MARKED FIXED TIME GRAPHS Ph.D. Thesis
John Philip Rankin 1978 133 p
Avail: Univ. Microfilms Order No. 7913350

Marked Fixed Time Graphs are introduced as a tool for modeling systems of decision free computations whose components have fixed execution times. The theory of these graphs is developed to the point where it can be used to verify whether or not a fixed time system enforces the precedence constraints between operations that are required by a time-independent specification of the system. This development involves the proof of two stabilization theorems; the first guarantees that vertex firing times always stabilize in a simulation of a marked fixed time graph, and the second gives a way to recognize stabilization when it occurs. Derived from these stabilization results is a characterization of bounded perpetual markings and a method to find the bounds when they exist. Scenario was designed in which marked untimed graphs are used to specify precedence constraints required between processes, and marked fixed time graphs are used to model the constraints physically realized. Dissert. Abstr.

N79-25784 Illinois Univ. at Urbana-Champaign, Urbana.
AN EFFICIENT NUMERICAL METHOD FOR HIGHLY OSCILLATORY ORDINARY DIFFERENTIAL EQUATIONS Ph.D. Thesis
Linda Ruth Petzold 1978 137 p
Avail: Univ. Microfilms Order No. 7913576

A quasi envelope of the solution of highly oscillatory differential equations is defined. Error propagation properties of this technique were investigated, and an automatic program is presented. Numerical results indicate that this technique is much more efficient than conventional ODE methods, for many oscillating problems. Dissert. Abstr.

N79-25785*# General Electric Co., Houston, Tex.
PROGRAM FOR THE SOLUTION OF MULTIPOINT BOUNDARY VALUE PROBLEMS OF QUASILINEAR DIFFERENTIAL EQUATIONS
10 Apr. 1973 47 p ref
(Contract NAS9-12932)
(NASA-CR-160208; TIR-741-MED-3023) Avail: NTIS HC A03/MF A01 CSCL 09B

Linear equations are solved by a method of superposition of solutions of a sequence of initial value problems. For nonlinear equations and/or boundary conditions, the solution is iterative and in each iteration a problem like the linear case is solved. A simple Taylor series expansion is used for the linearization of both nonlinear equations and nonlinear boundary conditions. The perturbation method of solution is used in preference to quasilinearization because of programming ease, and smaller storage requirements; and experiments indicate that the desired convergence properties exist although no proof or convergence is given. Author

N79-25786*# General Electric Co., Syracuse, N.Y.
PROGRAM FOR SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS
H. Sloate 2 May 1973 44 p refs
(Contract NAS9-12932)
(NASA-CR-160209; TIR-741-MED-3027) Avail: NTIS HC A03/MF A01 CSCL 09B

A program for the solution of linear and nonlinear first order ordinary differential equations is described and user instructions are included. The program contains a new integration algorithm for the solution of initial value problems which is particularly efficient for the solution of differential equations with a wide range of eigenvalues. The program in its present form handles up to ten state variables, but expansion to handle up to fifty state variables is being investigated. R.E.S.

N79-25787*# Lockheed Electronics Co., Houston, Tex.
WIDEBAND ANALOG DATA SYSTEM (WADS), SYSTEM DESIGN DOCUMENT
J. F. Brose Feb. 1979 93 p refs
(Contract NAS9-15200)
(NASA-CR-160180; LEC-13191; JSC-14727) Avail: NTIS HC A05/MF A01 CSCL 09B

The Wideband Analog System (WADS) which performs post flight structural dynamic analysis of wideband FM data recorded during orbital flight tests is defined. Screening, reporting, and plotting steady state and transient wave analysis data are provided by WADS. S.E.S.

N79-25788*# National Aeronautics and Space Administration, Washington, D. C.
PROJECT CAD AS OF JULY 1978: CAD SUPPORT PROJECT, SITUATION IN JULY 1978
L. Boesch, G. Lang-Lendorff, R. Rothenberg, and V. Stelzer Jun. 1979 180 p refs Transl. into ENGLISH of "Das Foerderprojekt CAD, Stand Juli 1978," Rept. KfK-CAD-50 Kernforschungszentrum, Karlsruhe, West Germany, Jul. 1978 p 1-156 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75635; KfK-CAD-50) Avail: NTIS HC A09/MF A01 CSCL 09B

The structure of Computer Aided Design (CAD) and the requirements for program developments in past and future are described. The actual standard and the future aims of CAD programs are presented. The developed programs in: (1) civil engineering; (2) mechanical engineering; (3) chemical engineering/shipbuilding; (4) electrical engineering; and (5) general programs are discussed. S.E.S.

N79-25789*# Auburn Univ., Ala. Dept. of Electrical Engineering.
AUTOMATIC TEST PATTERN GENERATION AND SIMULATION OF SEQUENTIAL LOGIC CIRCUITS Interim Report
B. D. Carroll 16 May 1977 93 p refs
(Contract NAS8-31572)
(NASA-CR-150304) Avail: NTIS HC A05/MF A01 CSCL 09B

The latest version of the SIMLOG logic simulation program is described. New features contained in the latest version include automatic race analysis, fault simulation, and a flexible starting state specification procedure. Problems that remains in the simulator are discussed. A proposed reorganization of the program to overcome some of these problems is presented. Flow charts and listings of the current program are included. S.E.S.

N79-25790# Stanford Univ., Calif. Systems Optimization Lab.
SOFTWARE FOR OPTIMIZATION
L. Nazareth Dec. 1978 42 p refs
(Contracts N00014-75-C-0267; EY-76-S-03-3326)
(AD-A066343; SU-SOL-78-32) Avail: NTIS HC A03/MF A01 CSCL 09/2

Our aim in this paper is to provide the reader with: some feel for what quality software entails, an overview of various

aspects of optimization software, information on solution techniques and available software in the form of a decision tree, and an extensive bibliography so that the reader can further pursue specific topics of interest. We concentrate upon linear programming, non-linear unconstrained optimization and related areas, and non-linear programming. GRA

N79-25791# Pennsylvania Univ., Philadelphia. Dept. of Computer and Information Sciences.

USE AND EXTENSION OF AN AUTOMATIC PROGRAM GENERATOR FOR MODEL BUILDING IN SOCIAL AND ENGINEERING SCIENCES Ph.D. Thesis

Jorge L. Gana Oct. 1978 493 p refs

(AD-A066192; Rept-78-02) Avail: NTIS HC A21/MF A01 CSCL 09/2

The growth in size and complexity of computer models used in economic and engineering studies has motivated research into the use of automatic program generation techniques as a cost effective alternative. This dissertation describes this new approach to the development of software needed at different stages of model building and simulation applications. It uses the computer itself to automatically generate ad-hoc application programs, based on a description given in a high level non-procedural Module Description Language (MODEL). The general objectives of this work were to use and extend the latest automatic program generation techniques in order to reduce the cost and computer oriented skills required to employ the modeling methodology. In doing so, a number of novel and useful features have been produced that contribute to a broader class of applications in which knowledge of mathematics and logic becomes sufficient, as opposed to the current demand of computer programming knowledge as well. New algorithms and techniques were also developed that enhanced the automatic generation of computer programs. GRA

N79-25792# Air Force Weapons Lab., Kirtland AFB, N. Mex.

SOME SPARSE MATRIX COMPUTER CODES Final Report

S. Hendrix Jan. 1979 28 p

(AD-A066810; AD-E200263; AFWL-TR-78-216) Avail: NTIS HC A03/MF A01 CSCL 12/1

This report discusses several computer codes for manipulating sparse matrices and solving the associated linear systems. In particular, a package for banded or diagonally structured matrices and one for general sparse matrices are discussed. The general package also includes an eigenvalue and eigenvector routine. Author (GRA)

N79-25793# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.

GENERATING SORTED LISTS OF RANDOM NUMBERS Interim Report

John Louis Bentley and James B. Saxe Mar. 1979 16 p refs

(Contract N00014-76-C-0370)

(AD-A066739; CMU-CS-79-113) Avail: NTIS HC A02/MF A01 CSCL 12/1

The empirical testing of a program often calls for generating a set of random numbers and then immediately sorting them. In this paper we consider the problem of accomplishing that process in a single step: generating a sorted list of random numbers (specifically, reals chosen uniformly from (0,1)). The method we describe generates the randoms in linear time, is perfectly random (if it can call a perfectly random generator for a single uniform), and can be described in just three lines of Algol or Pascal code. If the numbers are not required to be generated all at once (but are rather to be used one-at-a-time), then the method can be implemented as a subroutine to produce the next number and requires only constant storage. Author (GRA)

N79-25794# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.

THE ARGOS IMAGE UNDERSTANDING SYSTEM

Steven Rubin Nov. 1978 109 p refs

(Contract F44620-73-C-0074)

(AD-A066736; AFOSR-79-0087TR) Avail: NTIS HC A06/MF A01 CSCL 09/1

ARGOS is an image understanding system. It builds a three-dimensional model of the task domain and uses hypothesized two-dimensional views of the model to label images. It currently achieves less than 20% error by area when labeling real-world (city of Pittsburgh) photographs with a knowledge base of over fifty objects. In addition, the system can determine the angle of view around the city with approximately 40 degrees of error. The labeling technique used by ARGOS is called Locus search. Locus is a non-backtracking graph search technique in which a beam of near-miss alternatives around the best path are extended in parallel through the graph. After the graph has been searched in breadth-first order, the beam of possibilities is examined in reverse order to extract a near-optimal path. This path defines a labeling of the image and is only sub-optimal because of the pruning heuristics used in the beam creation. This thesis formulates image understanding as a problem of search; shows how Locus search can be used to label images; describes the many sources of knowledge used in the interpretation; shows how knowledge represented as a network can be used to constrain the search; explores extensions to the use of knowledge; and presents the experimental results of ARGOS. Its main contributions are the demonstration that Locus search can be used for image understanding and the exploration of issues involved in this use. GRA

N79-25795# Stanford Univ., Calif. Systems Optimization Lab.

A STUDY OF CONJUGATE GRADIENT METHODS

L. Nazareth and J. Nocedal Dec. 1978 56 p refs

(Contracts N00014-75-C-0267; EY-76-S-03-0326; Grants NSF MCS-76-200019; NSF ENG-77-06761)

(AD-A066391; SU-SOL-78-29) Avail: NTIS HC A04/MF A01 CSCL 12/1

A number of new properties of algorithms of the Conjugate Gradient type are shown, paying particular attention to methods which utilize variable metric information in determining the conjugate gradient search directions. A comprehensive discussion of conjugate gradient methods is attempted, and each algorithm is presented within the context of other existing algorithms, an approach which provides fresh insights and some new algorithms. GRA

N79-25796# Stanford Univ., Calif. Systems Optimization Lab.

MODELS TO AID THE IMPLEMENTATION OF LP ALGORITHMS

L. Nazareth Dec. 1978 23 p refs

(Contract N00014-75-C-0267; EY-76-S-03-0326; Grants NSF MCS-76-20019; NSF ENG-77-06761)

(AD-A066442; SU-SOL-78-28) Avail: NTIS HC A02/MF A01 CSCL 12/1

Implementing large scale LP algorithms is a difficult, laborious and often poorly rewarded task. This is particularly true of algorithms which exploit the structure of the LP matrix. For this reason many algorithms have been proposed in the literature, but few have been turned into good computer codes. Very little is known about the relative performance of different algorithms. In this paper we discuss some of the suggestions that have been made for alleviating this problem and describe an approach based upon a carefully defined collection of subroutines which are designed to aid the task for implementing and comparing LP algorithms. These subroutines or modules may be regarded as the 'primitives' of a language of implementing experimental LP algorithms, particularly algorithms which exploit matrix structure. A set of such modules is described. These have been implemented in FORTRAN, and user documentation is available. Author (GRA)

N79-25797# RAND Corp., Santa Monica, Calif.

DESIGN CONSIDERATIONS FOR COMPUTER-BASED INTERACTIVE MAP DISPLAY SYSTEMS Final Report

Robert H. Anderson and Norman Z. Shapiro Feb. 1979 59 p refs

(Contract MDA903-78-C-0084; ARPA Order 3478)

(AD-A066395; RAND/R-2382-ARPA) Avail: NTIS HC A04/MF A01 CSCL 09/2

Key features of an interactive map display system that affect both the usefulness of the system and the design and architecture of its hardware and software are discussed. Recent developments in computer graphics offer the possibility of creating interactive

map display systems having many of the advantages of traditional paper maps, but significant additional advantages as well. This report presents observations and guidelines for developers of interactive map systems. The techniques and design principles discussed are applicable to command and control systems ranging from support of a field commander through systems tailored to the needs of the National Command Authority. Author (GRA)

N79-25798# Carnegie-Mellon Univ., Pittsburgh, Pa. Management Sciences Research Group.
INTEGER AND FRACTIONAL MATCHINGS
Egon Balas Feb. 1979 23 p refs
(Contract N00014-75-C-0621; Grant NSF MPS-73-08534)
(AD-A067067; MSRR-426; WP-39-78-79) Avail: NTIS HC A02/MF A01 CSCL 12/1

We examine the connections between maximum cardinality edge matchings in a graph and optimal solutions to the associated linear program, which we call maximum f-matchings (fractional matchings). We say that a maximum matching M separates an odd cycle with vertex set S, if M has no edge with exactly one end in S. An odd cycle is separable if it is separated by at least one maximum matching. We show that a graph G has a maximum f-matching that is integer, if and only if it has no separable odd cycles; the minimum number q of vertex-disjoint odd cycles for which a maximum f-matching has fractional components, equals the maximum number s of vertex-disjoint odd cycles, separated by a maximum matching; the difference between the cardinality of a maximum f-matching and that of a maximum matching in G is one half times s; any maximum f-matching with fractional components for a minimum number s of vertex-disjoint odd cycles defines a maximum matching obtainable from it in s steps; and if a maximum f-matching has fractional components for a set Q of odd cycles that is not minimum, there exists another maximum f-matching with fractional components for a minimum-cardinality set S of odd cycles, such that S is a subset of Q, absival Q/S is even, and the cycles in Q/S are pairwise connected by alternating paths. Author (GRA)

N79-25799# Army Construction Engineering Research Lab., Champaign, Ill.
THE AUTOMATED DOCUMENTATION SYSTEM, USER MANUAL Final Report
Linda Lawrie Feb. 1979 88 p ref
(DA Proj. 4A7-62725-AT-11)
(AD-A067203; CERL-TR-E-147) Avail: NTIS HC A05/MF A01 CSCL 09/2

The Automated Documentation System (ADS) is a computer program and user procedure designed to facilitate management of the development of software and the production of final documentation of FORTRAN programs. The ADS system can be used in two ways. (1) At any point during development of the software, the status of the development process can be determined by application of the program to the source code under development. Flow charts and internal documentation are summarized for the program manager. (2) After the software is complete, external documentation can be produced from the internal documentation and compilation maps by running the ADS program. The ADS program is written in Control Data Corporation (CDC) FORTRAN extended, version 4.6 and can be used on CDC 6000/7000 series computers with few or no modifications. This report provides detailed user instructions for ADS. Author (GRA)

N79-25800# George Washington Univ., Washington, D. C. Inst. for Management Science and Engineering.
COMPUTING EQUILIBRIA VIA NONCONVEX PROGRAMMING
Jonathan F. Bard and James E. Falk 10 Nov. 1978 42 p refs
(Grant DAAG29-76-G-0150)
(AD-A067188; Serial-T-386; ARO-13622.6-M) Avail: NTIS HC A03/MF A01 CSCL 12/1

The problem of determining a vector that places a system in a state of equilibrium is studied with the aid of mathematical programming. The approach derives from the logical equivalence between the general equilibrium problem and the complementarity problem. When the excess demand function g(x) meets certain separability conditions, equilibrium solutions are obtained by using an established branch and bound algorithm. Because the best upper bound is known at the outset, an independent check for convergence can be made at each iteration of the algorithm, thereby greatly increasing its efficiency. A number of examples drawn from economic and network theory are presented in order to demonstrate the computational aspects of the approach. The results appear promising for a wide range of problem sizes and types, with solutions occurring in a relatively small number of iterations. GRA

N79-25801# Los Alamos Scientific Lab., N. Mex.
AUTOMATIC PROGRAM GENERATION: FUTURE OF SOFTWARE ENGINEERING
Joel H. Robinson 1979 20 p refs Presented at 12th Ann. Intern. Conf. on System Sci., Honolulu, 4 Jan. 1979
(Contract W-7405-eng-36)
(LA-UR-78-1849; Conf-790113-5) Avail: NTIS HC A02/MF A01

At this moment software development is still more of an art than an engineering discipline. Each piece of software is engineered, nurtured, and presented to the world as a tribute to the writer's skill. When will this change? When will the craftsmanship be removed and the programs be turned out like so many automobiles from an assembly line. Sooner or later it will happen: economic necessities will demand it. With the advent of cheap microcomputers and ever more powerful supercomputers doubling capacity, much more software must be produced. The choices are to double the number of programmers, double the efficiency of each programmer, or find a way to produce the needed software automatically. Producing software automatically is the only logical choice. How will automatic programming come about? DOE

N79-25802# Mathematics and Computation Lab., Washington, D. C. Applied Economics Div.
NEWECL: ECONOMIC COMPUTER LANGUAGE DATA HANDLERS Final Report
Rod L. Renner Dec. 1978 60 p Revised
(PB-290836/6; GSA/FPA/MCL-TM-25-Rev-2) Avail: NTIS HC A04/MF A01 CSCL 09B

An update to the NEWECL BASIC package is presented. The updated version is compatible with both RBASIC and ABASIC programs. The packet utilization procedure for ABASIC programs to access NEWECL is different from the procedure for RBASIC programs, which was not changed. Several sections of the manual were rewritten for clarification and the descriptions of two provisions of NEWECL-the overwrite protection feature and automatic file assignment with read/write keys-have been expanded. GRA

N79-25996# Royal Netherlands Navy, Nieuwe Haven (Netherlands). Centre for Automation of Weapon and Command Systems.
SOFTWARE FOR ROYAL NETHERLANDS NAVY
Johan B. F. Tasche *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 16 p refs (For primary document see N79-25977 16-99)
Avail: NTIS HC A16/MF A01

N79-25997# General Research Corp., Santa Barbara, Calif.
RESOURCE ANALYSIS FOR DATA-PROCESSING SOFTWARE
Edward N. Dodson *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 11 p refs (For primary document see N79-25977 16-99)
Avail: NTIS HC A16/MF A01

N79-26000# Rome Air Development Center, Griffiss AFB, N.Y.
HIGH ORDER LANGUAGE STANDARDIZATION
S. A. DiNitto, Jr. *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 8 p refs (For primary document see N79-25977 16-99)
Avail: NTIS HC A16/MF A01

62 COMPUTER SYSTEMS

Includes computer networks.

N79-25803 Illinois Univ. at Urbana-Champaign, Urbana.
DIAGNOSIS, SELF-DIAGNOSIS AND ROVING DIAGNOSIS IN DISTRIBUTED DIGITAL SYSTEMS Ph.D. Thesis
Ravindra Kumar Nair 1978 137 p
Avail: Univ. Microfilms Order No. 7913562

Various problems related to the diagnosis of systems which may be conveniently partitioned into subsystems on modules capable of performing tests among themselves were studied. The behavior of the diagnosability when systems having known diagnosabilities are interconnected to other systems was predicted. The roving diagnosis scheme reported is an attempt to achieve self diagnosis in distributed digital systems while involving as few units in diagnosis as possible at any given time. A window is associated with the subsystem composed of the testing and tested units. Diagnosis of the entire system is achieved by moving this window around the system. Related issues which are studied include reconfiguration of the system under a fault and the reusability of the system after reconfiguration. Certain properties of the system communications graph are shown to lead to desirable systems where the delay in reconfiguring around a fault is small. Dissert. Abstr.

N79-25804 Illinois Univ. at Urbana-Champaign, Urbana.
THE MINIMAL COVERING PROBLEM AND AUTOMATED DESIGN OF TWO-LEVEL AND/OR OPTIMAL NETWORKS Ph.D. Thesis
Ming Huei Young 1978 193 p
Avail: Univ. Microfilms Order No. 7913670

Efficient implicit enumeration algorithms for the minimal covering problem are presented. These algorithms are developed mainly for minimizing the logic expression of the switching function. The reducing property and the excluding property of the minimal covering problem are introduced to speed up the enumeration in solving problems. Symmetric property of the minimal covering problem is explored. Procedures for utilizing this property in the implicit enumeration algorithm were designed based on the theory of finite permutation group. The concept of an upper bound on the value of a group and of variable is reported. Dissert. Abstr.

N79-25992# GTE Sylvania, Inc., Needham Heights, Mass. Communication Systems Div.
TACTICAL AUTOMATED MESSAGE PROCESSING SYSTEMS
Ruth Nelson and Joseph Jarzembowski *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 7 p refs (For primary document see N79-25977 16-99)
Avail: NTIS HC A16/MF A01

N79-25993# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
[A TERMINAL FOR THE COMMUNICATION OF TACTICAL ALPHANUMERIC INFORMATION] [TERMINAL DE COMMUNICATIONS TACTIQUES D'INFORMATIONS ALPHANUMERIQUES]
G. Joseph (Sintra France) *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 18 p In FRENCH (For primary document see N79-25977 16-99)
Avail: NTIS HC A16/MF A01

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support.*

N79-25805*# Mississippi State Univ., Mississippi State. Dept. of Electrical Engineering.
IDENTIFICATION OF LIMIT CYCLES IN MULTI-NONLINEARITY, MULTIPLE PATH SYSTEMS Final Report, 1 Jan. 1978 - 31 May 1979
Jerrel R. Mitchell and Ottis L. Barron 29 May 1979 108 p refs
(Contract NAS9-32810)
(NASA-CR-161239; MSSU-EIRS-EE-79-4) Avail: NTIS HC A06/MF A01 CSCL 09B

A method of analysis which identifies limit cycles in autonomous systems with multiple nonlinearities and multiple forward paths is presented. The FORTRAN code for implementing the Harmonic Balance Algorithm is reported. The FORTRAN code is used to identify limit cycles in multiple path and nonlinearity systems while retaining the effects of several harmonic components. S.E.S.

N79-25806# Brown Univ., Providence, R. I. Lefschetz Center for Dynamical Systems.
CONTROL OF DYNAMICAL SYSTEMS Semiannual Progress Report
H. T. Banks, Jack K. Hale, E. F. Infante, and J. P. LaSalle Mar. 1979 19 p refs
(Grant AF-AFOSR-3092-76)
(AD-A067304; AFOSR-79-0455TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Six papers were published during the period of this report. Efforts were continued on approximation of delay systems with applications to optimal control and parameter identification. Studies are being made on the effects of delays on difference and differential-difference equations. Research has been centered on the stability properties of infinite-dimensional systems. Work has been completed on illustrating the effect of nonlinearities of controllability and stability and the tradeoffs required in order to meet control objectives and constraints on the state variables. Author (GRA)

N79-25807# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
FINITE-STATE CONTROL OF UNCERTAIN SYSTEMS M.S. Thesis. Interim Report
Steven Norman Jones Sep. 1978 125 p refs
(Grant AF-AFOSR-3281-77)
(AD-A062796; LIDS-TH-853; AFOSR-78-1515TR) Avail: NTIS HC A06/MF A01 CSCL 12A

An ambiguous process is defined as a closed, convex set of stochastic processes which fulfills certain properties. In the context of computer control, ambiguous processes are used as simplified models for the complex interaction of a nonlinear computer controller and continuous plant with uncertain dynamics. Author (GRA)

N79-25808# Arizona Univ., Tucson. Dept. of Mathematics.
DECOUPLING AND REDUCED ORDER MODELING OF TWO-TIME-SCALE CONTROL SYSTEMS
Leonard Robert Anderson Mar. 1979 134 p refs
(Contract N00014-76-C-0326)
(AD-A066532; TR-26) Avail: NTIS HC A07/MF A01 CSCL 09/3

This study presents new analytical findings and a new computational method for time-scale decoupling and order reduction of linear control systems. A transformation of variables reduces the system to block-diagonal form with slow and fast modes decoupled. Applications are made to two examples from the aeronautics literature. Author (GRA)

N79-25809# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
MULTICLASS OPERATIONAL ANALYSIS OF QUEUEING NETWORKS
J. D. Roode Nov. 1978 17 p refs
(CSIR-T-WISK-56) Avail: NTIS HC A02/MF A01

A multiclass queueing network model is presented. The model is developed using operational analysis and only the three basic operational principles are invoked. No stochastic assumptions are made only readily available operational data are used as input to the model. The network balance equations are derived and the product form of solution presented. Finally, algorithms are developed to calculate all performance quantities of interest. J.M.S.

N79-25104*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE CONSTANTIN-RAO CONSTRUCTION FOR BINARY ASYMMETRIC ERROR-CORRECTING CODES
R. J. McEliece and E. R. Rodemich *In its* The Deep Space Network 15 Jun. 1979 p 124-129 refs (For primary document see N79-25088 16-12)
Avail: NTIS HC A11/MF A01 CSCL 09B

N79-25107*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CODES FOR A PRIORITY QUEUE ON A PARALLEL DATA BUS
D. E. Wallis and H. Taylor *In its* The Deep Space Network 15 Jun. 1979 p 141-143 (For primary document see N79-25088 16-12)
Avail: NTIS HC A11/MF A01 CSCL 09B

N79-25110*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
QUICK-LOOK DECODING SCHEMES FOR DSN CONVOLUTIONAL CODES
C. A. Greenhall and R. L. Miller *In its* The Deep Space Network 15 Jun. 1979 p 162-166 ref (For primary document see N79-25088 16-12)
Avail: NTIS HC A11/MF A01 CSCL 09B

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N79-25810 State Univ. of New York at Buffalo.
CONTRIBUTIONS TO AXIOMATIC RECURSION THEORY Ph.D. Thesis
Robert Edwin Byerly 1979 130 p
Avail: Univ. Microfilms Order No. 7913868

Several different aspects of the concept of recursiveness are examined, and the role they play in the general theory is analyzed. The theory of algorithms applicable to abstract mathematical structures is presented, and the theorems of elementary recursion theory are classified according to the properties that must be imposed on the underlying structure to prove them. The standard godel numbering of the partial recursive functions is examined and a natural class of automorphisms of the godel numbers defined. Several axiomatizations, based on the URS and BRFT axiomatizations of Wagner and Strong, are presented, and various natural classes of models of these axiomatizations are considered. Dissert. Abstr.

N79-25811*# National Aeronautics and Space Administration, Washington, D. C.
UNIVERSAL ALGORITHMS AND PROGRAMS FOR CALCULATING THE MOTION PARAMETERS IN THE TWO-BODY PROBLEM
B. Ts. Bakhshiyan and A. A. Sukhanov Jun. 1979 42 p refs Transl. into ENGLISH from report Pr-420 (Moscow), 1978 55 p Transl. by Scientific Translation Service, Santa Barbara, Calif. Original document prepared by Inst. of Space Research, Moscow
(Contract NASw-3198)
(NASA-TM-75623) Avail: NTIS HC A03/MF A01 CSCL 12A

The algorithms and FORTRAN programs for computing positions and velocities, orbital elements and first and second partial derivatives in the two-body problem are presented. The algorithms are applicable for any value of eccentricity and are convenient for computing various navigation parameters. Author

N79-25812*# National Aeronautics and Space Administration, Washington, D. C.
NUMERICAL METHODS OF SOLVING A SYSTEM OF MULTI-DIMENSIONAL NONLINEAR EQUATIONS OF THE DIFFUSION TYPE
A. V. Agapov and B. I. Kolosov Jun. 1979 26 p refs Transl. into ENGLISH of "Chislennyye Metody Resheniya Sistem Mnogomernykh Nelineynykh Uravneniy Diffusionnogo Tipa", Rept. Pr-428 Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1978 p 1-24 Transl. by Sci. Transl. Serv., Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75630; Pr-428) Avail: NTIS HC A03/MF A01 CSCL 12A

The principles of conservation and stability of difference schemes achieved using the iteration control method were examined. For the schemes obtained of the predictor-corrector type, the conversion was proved for the control sequences of approximate solutions to the precise solutions in the Sobolev metrics. Algorithms were developed for reducing the differential problem to integral relationships, whose solution methods are known, were designed. The algorithms for the problem solution are classified depending on the non-linearity of the diffusion coefficients, and practical recommendations for their effective use are given. S.E.S.

N79-25813*# Lockheed Electronics Co., Houston, Tex. Systems and Service Div.
FISHER CLASSIFIER AND ITS PROBABILITY OF ERROR ESTIMATION
C. B. Chittineni May 1979 22 p refs
(Contract NAS9-15800)
(NASA-CR-160181; LEC-13301; JSC-14865) Avail: NTIS HC A02/MF A01 CSCL 12A

Computationally efficient expressions are derived for estimating the probability of error using the leave-one-out method. The optimal threshold for the classification of patterns projected onto Fisher's direction is derived. A simple generalization of the Fisher classifier to multiple classes is presented. Computational expressions are developed for estimating the probability of error of the multiclass Fisher classifier. S.E.S.

N79-25814# Orange Free State Univ., Bloemfontein (South Africa). Dept. of Mathematical Statistics.
ASYMPTOTIC DISTRIBUTIONS FOR THE STEIN ESTIMATOR IN MULTIPLE REGRESSION
P. C. N. Groenewald (Univ. of Fort Hare, S. Africa) and A. J. VanDerMerwe Jul. 1978 39 p refs
(TR-32) Avail: NTIS HC A03/MF A01

Marginal distributions are found and compared with those of the maximum likelihood estimator. These marginal distributions are useful in obtaining confidence limits for the Stein estimator. The asymptotic distribution of the quadratic loss function for the Stein estimator is also derived and compared with that of the maximum likelihood estimator. G.Y.

N79-25815# Arizona Univ., Tucson. Dept. of Mathematics.
SOME TWO PARAMETER PROBLEMS FOR SINGULARLY PERTURBED EQUATIONS OF ELLIPTIC TYPE
F. A. Howes Apr. 1979 39 p refs
(Contract N00014-76-C-0326)
(AD-A067271; TR-27) Avail: NTIS HC A03/MF A01 CSCL 12/1

This problem determines the asymptotic solution of boundary value problems for nonlinear singularly perturbed equations such as epsilon delta u = muA(x,u)xdelta u + h(x,u) where epsilon and mu are small parameters. The equations are more nonlinear than those considered previously, and more detailed information is obtained about boundary layer behavior and the necessary interrelationships between parameters. GRA

N79-25816# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
AN ALPHARD SPECIFICATION OF A CORRECT AND EFFICIENT TRANSFORMATION ON DATA STRUCTURES Interim Report
Jon L. Bentley and Mary Shaw Dec. 1978 31 p refs Presented at the IEEE Conf. on Specifications of Reliable Software, Pittsburgh, Apr. 1979
(Contract N00014-76-C-0370; Grant NSF MCS-77-03883)
(AD-A066897; CMU-CS-79-100) Avail: NTIS HC A03/MF A01 CSCL 09/2

In this paper we study standard program components applicable to a wide variety of design tasks; we choose for this study the specific problem domain of data structures for general search problems. Within this domain transformations for converting solutions of simple searching problems to solutions of more complex problems have been developed. We discuss

one of those transformations, specify precisely the transformation and its conditions of applicability, and prove its correctness; we accomplish this by casting it in terms of abstract data types -- specifically by using the Alphard form mechanism. We also demonstrate that the costs of the structures derived by this transformation are only slightly greater than the costs of the original solutions. The transformation we describe has already been used to develop a number of new algorithms, and it represents a new level of generality in software engineering tools. GRA

N79-25817# Naval Research Lab., Washington, D. C.
CUBIC SPLINE SOLUTION OF INTEGRAL EQUATIONS Interim Report
George P. Mueller and Mervine Rosen 5 Mar. 1979 20 p refs
(RR0221141; RR0210302)
(AD-A067297; AD-E000285; NRL-MR-3942) Avail: NTIS HC A01/MF A01 CSCL 12/1

The solution of linear integral equations of the form f1(x)g(x)+ f2(x)g(x)f3(x) - integral b(x)/a(x) dyK(x,y)g(P(x,y)) is considered. The equation is reduced to a set of linear algebraic equations in the values of g(x) on a finite mesh. The method entails formal orthogonal polynomial quadrature of the integral and subsequent formal cubic spline interpolation for the values of g at the mesh points. Discontinuities in the derivatives of g are accommodated. GRA

N79-25818# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
OPTIMAL EXPECTED-TIME ALGORITHMS FOR CLOSEST-POINT PROBLEMS
John Louis Bentley, Bruce W. Weide (Ohio State Univ., Columbus), and Andrew C. Yao (Stanford Univ., Calif.) Mar. 1979 20 p refs
(Contract N00014-76-C-0370)
(AD-A066740; CMU-CS-79-111) Avail: NTIS HC A02/MF A01 CSCL 12/1

Geometric closest-point problems deal with the proximity relationships in k-dimensional point sets. Examples of closest-point problems include building minimum spanning trees, nearest neighbor searching, and triangulation construction. Shamos and Hoey (1975) have shown how the Voronoi diagram can be used to solve a number of planar closest-point problems in optimal worst-case time. In this paper we extend their work by giving optimal expected-time algorithms for solving a number of closest-point problems in k-space, including nearest neighbor searching, finding all nearest neighbors, and computing planar minimum spanning trees. In addition to establishing theoretical bounds, the algorithms in this paper can be implemented to solve practical problems very efficiently. Author (GRA)

N79-25819# Stanford Univ., Calif. Systems Optimization Lab.
ERROR PROPAGATION AND SOLUTION RECONSTRUCTION IN NESTED DECOMPOSITION
L. Nazareth Dec. 1978 34 p refs
(Contracts N00014-75-C-0267; EY-76-S-03-0326; Grants NSF MCS-76-20019; NSF ENG-77-06761)
(AD-A066441; SU-SOL-78-27) Avail: NTIS HC A03/MF A01 CSCL 12/1

We study some of the numerical properties of the nested decomposition algorithm of Ho and Manne. In particular, we seek to show how well developed theory in the area of computational linear algebra, due primarily to J. H. Wilkinson, carries over to linear programming and yields useful insight into the behavior of algorithms in this area. Author (GRA)

N79-25820# Stanford Univ., Calif. Systems Optimization Lab.
DUALLY EQUIVALENT DECOMPOSITION ALGORITHMS WITH APPLICATION TO SOLVING STAIRCASE STRUCTURES
L. Nazareth Dec. 1978 36 p refs
(Contracts N00014-75-C-0267; EY-76-S-03-0326; Grants NSF MCS-76-20019; NSF ENG-77-06761)
(AD-A066443; SU-SOL-78-30) Avail: NTIS HC A03/MF A01 CSCL 12/1

We briefly go over the well known dual relationship between Dantzig-Wolfe Decompostion and Benders Decompsoition, in order to develop suitable notation and then elaborate upon the dual relationship between nested versions of Dantzig-Wolfe and Benders Decomposition. Next, we develop a new pair of dually related decompostions termed symmetric Dantzig-Wolfe and symmetric Benders Decomposition. Finally, we discuss the advantages and disadvantages of applying nested and symmetric decompositions to structured LP problems, in particular to staircase structures. Author (GRA)

N79-25821# Air Force Human Resources Lab., Brooks AFB, Tex.
GENERALIZED APPROACH FOR PREDICTING A DICHOTOMOUS CRITERION Interim Report, Oct. 1977 - Mar. 1978
Jack R. Dempsey, Wayne S. Sellman, and Jonathan C. Fast Feb. 1979 20 p refs
(AD-A066661; AFHRL-TR-78-84) Avail: NTIS HC A02/MF A01 CSCL 05/9

This report refines and improves upon a conceptual model and a mathematical procedure, based upon a blend of Likelihood Function Estimation (LIFE) and utility theory. Empirical studies conducted by the Air Force Military Personnel Center in 1975 and 1976 have shown that the LIFE procedure can be very useful in the prediction and study of dichotomous behavior, e.g., predicting attrition/success of a trainee in an Air Force Training program. The technique has been previously used to study attrition from the United States Air Force Academy and Basic Military training. By generalizing the LIFE technique it can be applied to the situation of studying and predicting any dichotomous dependent variable. Currently, the Air Force Human Resources Laboratory is continuing studies of the procedure to compare its usefulness to other mathematical methods. Author (GRA)

N79-25822# Naval Postgraduate School, Monterey, Calif. Dept. of Operations Research.
SIMPLE MODELS FOR POSITIVE-VALUED AND DISCRETE-VALUED TIME SERIES WITH ARMA CORRELATION STRUCTURE
P. A. W. Lewis Nov. 1978 43 p refs Presented at the Intern. Symp. on Multivariate Analysis Submitted for publication
(Grant NSF AF-476; RR0140501)
(AD-A066355; NPS55-78-033) Avail: NTIS HC A03/MF A01 CSCL 12/1

Three models for positive-valued and discrete-valued stationary time series are discussed. All have the property that for a range of specified marginal distributions the time series have the same correlation structure as the usual linear, autoregressive-moving average (ARMA) model. The models differ in the range of marginal distributions which can be accommodated and in the simplicity and flexibility of each model. Specifically, the EARMA-type processes can be extended from the exponential distribution to a rather narrow range of continuous distributions; the DARMA-type processes can be defined usefully for any discrete marginal distribution and are simple and flexible. Finally the marginally controlled semi-Markov generated process can be defined for any continuous or discrete positive-valued distribution and is therefore very flexible. However, the model suffers from some complexity and parametric obscurity. Author (GRA)

N79-25823# Naval Underwater Systems Center, New London, Conn.
A STATE VARIABLE APPROACH TO STATIONARY TIME SERIES WITH APPLICATION FOR PREDICTING DISPLACEMENT IN A LARGE UNDERWATER SUSPENDED ARRAY
Richard J. Nielsen 21 Feb. 1979 50 p refs
(AD-A067284; NUSC-TR-5893) Avail: NTIS HC A03/MF A01 CSCL 12/1

State variable representation of systems is developed, together with the solution to the state space equation. The Kalman filter theory is outlined along with its extension to stationary processes and prediction. The relationship of the Kalman filter to the Wiener filter is also indicated. The motion of a large underwater suspended array is described in terms of the power spectrum of its displacement fluctuations. The variance of the error in the predicted array displacement is estimated, using Kalman filter theory based

on 1- and 2-pole approximations of the displacement power spectrum. Closed-form expressions are maintained throughout the development. The results of the study show that the predicted array displacements are sensitive to the power spectral approximation, and that large errors in the displacement predictions can occur in relatively short periods of time. Author (GRA)

N79-25824# Lincoln Lab., Mass. Inst. of Tech., Lexington.
OPTIMAL STATE ESTIMATION OF BALLISTIC TRAJECTORIES WITH ANGLE-ONLY MEASUREMENTS
Chaw-Bing Chang 24 Jan. 1979 51 p refs
(Contract F19628-78-C-0002; DA Proj. 8X3-63304-D-215)
(AD-A067354; TN-1979-1; ESD-TR-79-5) Avail: NTIS HC A04/MF A01 CSCL 19/4

An iterative least square estimation algorithm is derived and applied to the problem of state estimation of ballistic trajectories with angle-only measurements. A filter initiation procedure is suggested. The application of trajectory a priori knowledge for improving the estimate is discussed and solved as a constrained estimation problem. A Monte Carlo simulation study was conducted to evaluate these techniques. It was found that the iterative least square filter achieves the Cramer-Rao bound and it performs better than the extended Kalman filter when the sensor is on a free-falling platform. When the sensor is on a stationary platform however, both estimators asymptotically achieve the Cramer-Rao bound. Author (GRA)

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N79-25825 Cornell Univ., Ithaca, N. Y.
SOME PROPERTIES OF ESTIMATED ASYMPTOTIC VARIANCES AND CONVARIANCES FOR LOGLINEAR MODELS IN MULTIDIMENSIONAL CONTINGENCY TABLES Ph.D. Thesis
Isabel Elaine Allen 1979 246 p
Avail: Univ. Microfilms Order No. 7910730

Several properties of the variances of rafter u terms in loglinear models were examined. The estimated asymptotic variance of rafter u for calculating estimated asymptotic variances. Two examples, comparing the methods, show that the delta method gives the smallest overall variances. The differences between variance estimates when the model is misspecified is presented. The use of simultaneous confidence intervals is partitioning a rafter u term when some of the levels are more important than others, and an example of this technique, is discussed. The approximate small sample variance structure of rafter u terms was investigated using Taylor expansions. A simulation designed to exploit small sample size and small cell size, compared the approximate small sample variance and the delta method variance for several models of two, three, and four dimensional tables. For most models this variance was between the other two variances. For some large sample models this variance was very slightly smaller than the approximate small sample variance.
Dissert. Abstr.

N79-25826# Orange Free State Univ., Bloemfontein (South Africa). Dept. of Mathematical Statistics.
A REVIEW OF MATRIX DIFFERENTIATION IN STATISTICS
D. G. Nel Nov. 1978 38 p refs
(TR-38) Avail: NTIS HC A03/MF A01

The different matrix derivative methods available in terms of a common notation based on the Bargmann matrix calculus is presented. Matrix derivatives of specific scalar functions are considered as well as matrix derivatives of scalar functions in general with reference to the derivative with respect to a symmetric matrix. The matrix derivatives of matrix functions are presented along with the two possibilities of arranging the derivatives. The matrix derivatives of Kronecker products and second order matrix derivatives are reviewed and derivative methods to evaluate some Jacobians are described. M.M.M.

N79-25827# Florida State Univ., Tallahassee. Dept. of Statistics.
A BAYESIAN APPROACH TO BIOASSAY
D. Basu and Richard Fagerstrom Feb. 1979 16 p refs
(Grants NSF MCS-77-01661; DAAG29-76-G-0238)
(AD-A067273; FSU-Statistics-M498; TR-D32; ARO-13888.16-MX) Avail: NTIS HC A02/MF A01 CSCL 12/1

This article explains in general terms how some sequential bioassay methods, like the stochastic approximation method or the up-and-down method, are not in conformity with the likelihood principle. Irrespective of the sampling plan, the bioassay data may be analyzed in terms of the following simple prior probability model for the response probabilities. Let x sub 1 < x sub 2 < x sub m be the distinct dosage levels used in a bioassay experiment and let p sub 1 < p sub 2 < p sub m be the corresponding unknown response probabilities. The u's are regarded as mutually independent random variables taking values in the unit interval. The p sub 's then form a Markov chain. The means and the variances of the P sub 's are related to those of the u sub 's in a rather simple fashion. The case where u sub 1 's approx Beta (1, lambda sub i) is found to be particularly tractable for the analysis of bioassay data. Author (GRA)

N79-25828# Naval Ship Research and Development Center, Bethesda, Md.
ACCURACY AND EFFICIENCY IN PATTERN CLASSIFICATION
S. Berkowitz Mar. 1979 44 p refs
(AD-A066511; DTNSRDC-79-029) Avail: NTIS HC A03/MF A01 CSCL 12/1

A pattern classification scheme which is grounded in classical probability theory may be associated with confidence intervals that represent an estimate of the predictive capability of the scheme. As a practical matter, realistic allocations of data acquisition and processing resources may severely constrain acceptable levels of predictability. We examine some of the basic assumptions which underlie the standard statistical techniques. In particular, we show that fuzzy logic effectively produces conservative estimates for the conditional probability of the union of sets since, in that case, it neglects information related to the intersection. We propose that such neglect can be remedied, at a computational cost, without resorting explicitly to the usual procedure of integrating over irregularly shaped volumes. To this end, we introduce a class of probability density distributions which possesses (hyper) rectangular contour. Explicit formulas for the normalization constant and the probability of error are then derived for typical distributions. GRA

N79-25829# Naval Ocean Systems Center, San Diego, Calif.
POISSON SPECTRAL ESTIMATION USING HARDLIMITED SAMPLES Research Report, Oct. 1977 - Sep. 1978
D. M. Klamer 15 Oct. 1978 30 p refs
(AD-A066376; NOSC/TR-334) Avail: NTIS HC A03/MF A01 CSCL 12/1

In this report, the problem of reconstructing the spectral density of a Gaussian signal process from hardlimited observations taken at Poisson sampling instants was considered. The estimate was shown to be asymptotically unbiased as the number of observation points approached infinity. In addition, the covariance of the estimate was also asymptotically bounded as the number of observations tended to infinity. The focus of future work will be to obtain tighter bounds on the covariance of the estimate and to show that these bounds tend to zero as the number of observations tends to infinity. Author (GRA)

N79-25830# Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).
ESTIMATION OF CONTINUOUS-TIME PROCESSES WITH DISCRETE MEASUREMENTS BY HERMITE POLYNOMIAL EXPANSIONS WITH APPLICATION TO AN ORBIT DETERMINATION PROBLEM. PART 1: THEORETICAL FOUNDATIONS Final Report
L. Chiariglione and L. C. Corgnier Paris ESA Jul. 1978 94 p refs 2 Vol.
(Contract ESOC-2966/76-D-JS)
(CSELT-RI-78-05-265-Vol-1; ESA-CR(P)-1148-Vol-1) Avail: NTIS HC A05/MF A01

A method for the solution of the estimation problem of time-continuous stochastic process when measurements are discrete in time is proposed. The method is based on the representation of a probability density, as the product of a Gaussian density, by a series of Hermitian polynomials in order to take into account the deviations from normality of the probability densities which are encountered in nonlinear systems. The method was tested on a case with an analytically known solution and applied to the estimation of a plane orbit with air drag when range measurements are taken at discrete times. Author (ESA)

N79-25831# Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).
ESTIMATION OF CONTINUOUS-TIME PROCESSES WITH DISCRETE MEASUREMENTS BY HERMITE POLYNOMIAL EXPANSIONS WITH APPLICATIONS TO AN ORBIT DETERMINATION PROBLEM. PART 2: PROGRAM DESCRIPTION Final Report
L. Chiariglione and L. C. Corgnier Paris ESA Jul. 1978 101 p refs 2 Vol.
(Contract ESOC-2966/76-D-JS)
(CSELT-RI-78-05-266-Vol-2; ESA-CR(P)-1148-Vol-2) Avail: NTIS HC A06/MF A01

The programs described were developed to solve the plane-orbit estimation problem. The method given in Estimation of Continuous-time Processes with Discrete Measurements by Hermite-Polynomial Expansions with Application to an Orbit Determination Problem. Part 1: Theoretical Foundations were used. The description includes general considerations on the program, rules for using it, and indications for extensions and modifications. Author (ESA)

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N79-25832# Cornell Univ., Ithaca, N. Y. School of Operations Research and Industrial Engineering.
INTERNATIONAL WORKSHOP ON GAME THEORY (4TH): MULTIPERSON GAME THEORY AND ITS APPLICATIONS Technical Report, Apr. - Aug. 1978
W. F. Lucas Aug. 1978 57 p refs Workshop held at Ithaca, N. Y., 18 Jun. - 1 Jul. 1978
(Contracts N00014-78-M-0048; DAAG29-78-M-0105)
(AD-A066731; TR-392) Avail: NTIS HC A04/MF A01 CSCL 12/1

This report on the Fourth International Workshop on Game Theory held in Ithaca, New York in 1978 contains a brief report on workshop activities, comments on scientific developments, a list of 55 participants, and 50 abstracts of the formal talks presented at the Workshop. Author (GRA)

N79-25833# Cornell Univ., Ithaca, N. Y. School of Operations Research and Industrial Engineering.
THE VALUE OF THE NON-ATOMIC GAME ARISING FROM A RATE-SETTING APPLICATION AND RELATED PROBLEMS
Joseph Raanan Apr. 1978 75 p refs
(Contract N00014-75-C-0678; Grant NSF MPS-75-02024)
(AD-A066729; TR-372) Avail: NTIS HC A04/MF A01 CSCL 12/1

The work is motivated by the following problem: bulk-service telephone lines were installed at Cornell Universtiy, to be used for long-distance calls. The charges paid to the telephone company are mostly fixed monthly charges and are not usage-related. The problem is how to allocate these costs back to the users in a per call fashion, and how to do it in a way that is fair and efficient. The problem was solved by using the value of the associated non-atomic game. To be able to do this, the theory of non-atomic games had to be extended by weakening certain differentiability requirements. This is done here; in addition, a number of results about full-range game are obtained. Next, the problem of non-atomic linear production games is studied. A number of results about the cores of such games are obtained, extending and strengthening similar results about finite linear production games. In addition, some results about the value of such games are established, and relationships between the core and the value are derived for a special case. Author (GRA)

N79-25834# Cornell Univ., Ithaca, N. Y. School of Operations Research and Industrial Engineering.
STABLE SETS FOR SYMMETRIC, N-PERSON COOPERATIVE GAMES
Shiego Muto Aug. 1978 144 p refs
(Contract N00014-75-C-0678; Grants NSF MPS-75-02024; NSF MCS-77-28392)
(AD-A066730; TR-387) Avail: NTIS HC A07/MF A01 CSCL 12/1

Stable sets and subsolutions are studied mainly for symmetric, n-person, characteristic-function form games (n;k) in which k-person coalitions are strongly vital, i.e., $v(s) < \text{or equal to } s\ v(k)x(/k)$ for $k <$ or equal to $s <$ or equal to $n-1$ and $v(s) = 0$ for all $s < k$. GRA

N79-25835# Maryland Univ., College Park. Computer Science Center.
LOCAL RECONFIGURATION OF NETWORKS OF PROCESSORS
Angela Wu and Azriel Rosenfeld Feb. 1979 42 p refs
(Grant AF-AFOSR-3271-77)
(AD-A067332; TR-730; AFOSR-79-0443TR) Avail: NTIS HC A03/MF A01 CSCL 12/2

This paper studies a local approach to reconfiguration of networks of processors, in which new connections are created only between pairs of processors that have a common neighbor. Algorithms for transforming strings into cycles, trees, arrays, hypercubes, cliques, stars and wheels, and vice versa are presented. The generation of all possible configurations of a given set of processors is also discussed. Author (GRA)

N79-25836# California Univ., Livermore. Lawrence Livermore Lab.
DYNEST: A DYNAMIC ESTIMATOR CALCULATION PROGRAM
R. N. Castleton and J. V. Candy Feb. 1979 127 p refs
(Contracts DOE-40-550-75; NRC-Fin-A-A-0115)
(PB-292351/4; UCRL-52573; NUREG-CR-0531) Avail: NTIS HC A07/MF A01 CSCL 12B

The implementation and application of the computer code DYNEST (DYNamic ESTimator) written in FORTRAN IV are discussed. DYNEST is a first-generation program developed at the Lawrence Livermore Laboratory to calculate state estimates of a (nonlinear or linear) dynamic system from noisy measurement data. Plots and data files containing the estimates, together with their corresponding errors, are generated. DYNEST is applied to a simple nonlinear example, and the necessary subroutine are provided. Graphical outputs are presented. The code is applied to solve a nonlinear parameter estimation problem. GRA

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N79-25837# California Univ., Berkeley. College of Engineering.
FUZZY SETS AS A BASIS FOR INFORMATION ANALYSIS Final Report, 1 Nov. 1974 - 30 Sep. 1978
L. A. Zadeh Mar. 1979 9 p refs
(Grants DAHC04-75-G-0056; DAHC04-76-G-0107)
(AD-A067211; ARO-12596.8-EL) Avail: NTIS HC A02/MF A01 CSCL 09/4

Application of the theory of fuzzy sets to the processing of information which is imprecise, incomplete or not totally reliable, and a linguistic approach to concept definition and system analysis is discussed. Author (GRA)

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N79-25838 Iowa Univ., Iowa City.
A FINITE ELEMENT APPROACH TO THE DYNAMIC CONTACT PROBLEM Ph.D. Thesis
Nels Howard Madsen 1978 151 p
Avail: Univ. Microfilms Order No. 7912882

The application of finite element techniques to a procedure for the solution of dynamic contact problems is discussed. The procedure determines the region of contact between two bodies for each instant of the contact. The contact forces and the displacements of each of the two bodies are also obtained. The problem is formulated so that these results can be obtained with little additional effort over that needed for the finite element solution of any dynamics problem. The procedure poses the equations of motion subjected to the constraints of contact, and solves them for each instant of contact. The procedure is tested on several problems and the potential for extensive applications is pointed out. Dissert. Abstr.

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N79-25839 Georgia Inst. of Tech., Atlanta.
APPLICATION OF FINITE ELEMENT TECHNIQUES IN PREDICTING THE ACOUSTIC PROPERTIES OF TURBOFAN INLETS Ph.D. Thesis
Rudramuni Kariveerappa Majjigi 1979 196 p
Avail: Univ. Microfilms Order No. 7913795

The finite element method in combination with the method of weighted residuals was chosen as the solution technique for predicting the acoustic properties of variable area, annular ducts with or without acoustic treatments along their walls. An approximate solution for the steady inviscid flow field is obtained using an integral method for calculating the incompressible potential flow field in the inlet with a correction to account for compressibility effects. The accuracy of the technique in predicting the acoustic properties of annular ducts was checked by comparison with available analytical solutions for the problems of plane and spinning wave propagation through a hard walled annular cylinder with a constant mean flow. Dissert. Abstr.

N79-25840*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TONE NOISE OF THREE SUPERSONIC HELICAL TIP SPEED PROPELLERS IN A WIND TUNNEL
James H. Dittmar, Robert J. Jeracki, and Bernard J. Blaha 1979 66 p refs Presented at 97th Meeting of the Acoustical Soc. of Am., Cambridge, Mass., 11-15 Jun. 1979
(NASA-TM-79167; E-030) Avail: NTIS HC A04/MF A01 CSCL 20A

Three supersonic helical tip speed propellers were tested in the NASA Lewis 8- by 6-foot wind tunnel. This is a perforated-wall wind tunnel but it does not have acoustic damping material on its walls. The propellers were tested at tunnel through flow Mach numbers of 0.6, 0.7, 0.75, 0.8, and 0.85 with different rotational speeds and blade setting angles. The three propellers, which had approximately the same aerodynamic performance, incorporated different plan forms and different amounts of sweep and yielded different near field noise levels. The acoustically designed propeller had 45 deg of tip sweep and was significantly quieter at M = 0.8 cruise than the straight bladed propeller. The intermediate 30 deg tip sweep propeller, which was swept for aerodynamic purposes, exhibited noise that was between the other two propellers. Noise trends with varying helical tip Mach number and blade loading were also observed. Author

N79-25841*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ASSESSMENT AT FULL SCALE OF NOZZLE/WING GEOMETRY EFFECTS ON OTW AERO-ACOUSTIC CHARACTERISTICS
D. Groesbeck and U. vonGlahn 1979 31 p refs
(NASA-TM-79168; E-031) Avail: NTIS HC A03/MF A01 CSCL 20A

The effects on acoustic characteristics of nozzle type and location on a wing for STOL engine over-the-wing configurations are assessed at full scale on the basis of model-scale data. Three types of nozzle configurations are evaluated: a circular nozzle with external deflector mounted above the wing, a slot nozzle with external deflector mounted on the wing and a slot nozzle mounted on the wing. Nozzle exhaust plane locations with respect to the wing leading edge are varied from 10 to 46 percent chord (flaps retracted) with flap angles of 20 (takeoff altitude) and 60 (approach attitude). Perceived noise levels (PNL) are calculated as a function of flyover distance at 152 m altitude. From these plots, static EPNL values, defined as flyover relative noise levels, are calculated and plotted as a function of lift and thrust ratios. From such plots the acoustic benefits attributable to variations in nozzle/deflector/wing geometry at full scale are assessed for equal aerodynamic performance. Author

N79-25842# Christopher Newport Coll., Newport News, Va. Dept. of Physics and Engineering.
AN APPLICATION OF CATASTROPHE THEORY TO EDGE-TONE PHENOMENA
A. M. Buoncristiani and G. R. Webb Mar. 1979 92 p refs
Avail: NTIS HC A05/MF A01

The edge-tone exhibits discontinuities and hysteresis in frequency when the controls, the speed of the jet and the distance of the edge from the orifice of the jet, vary smoothly. Such discontinuous behaviors lend themselves to modeling by elementary catastrophes with superimposed structure. This augmented theory, when focused on the discontinuities and hysteresis, yields a global model for both the discontinuous and smooth functioning of the tone. The model displays explicitly the dependence on the two control variables, and appears as an ordinary differential equation that governs the variation in the amplitude of the tone. Author

N79-25843*# Douglas Aircraft Co., Inc., Long Beach, Calif.
VALIDATION OF AIRCRAFT NOISE PREDICTION PROGRAM Final Report, 21 Jun. 1978 - 21 Jan. 1979
C. Y. Kapper Jun. 1979 84 p refs
(Contract NAS1-15471)
(NASA-CR-159047) Avail: NTIS HC A05/MF A01 CSCL 20A

Predictions made with NASA's aircraft noise prediction program (ANOPP) were compared with flyover noise data. A data base of six flyover noise runs for the DC-10-40/JT9D-59A configuration was used. For all power settings, ANOPP consistently underpredicted the low frequency spectral levels, overpredicted high frequency spectral levels and, consequently, overpredicted the inlet and aft PNLT time histories. A.R.H.

N79-25844*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
AN EXPERIMENTAL INVESTIGATION OF THE EFFECT OF ROTOR TIP SHAPE ON HELICOPTER BLADE-SLAP NOISE
Danny R. Hoad May 1979 464 p refs Prepared in cooperation with Army Res. and Technol. Labs., Hampton, Va.
(NASA-TM-80066) Avail: NTIS HC A20/MF A01 CSCL 20A

The effect of tip-shape modification on blade-vortex interaction-induced helicopter blade-slap noise was investigated. The general rotor model system (GRMS) with a 3.148 m (10.33 ft) diameter, four-bladed fully articulated rotor was installed in the Langley V/STOL wind tunnel. The tunnel was operated in the open-throat configuration with treatment to improve the semi-anechoic characteristics of the test chamber. Based on previous investigation, four promising tips (ogee, sub-wing, 60 deg swept-tapered, and end-plate) were used along with a standard square tip as a baseline configuration. Aerodynamic and acoustical data concerning the relative applicability of the various tip configurations for blade-slap noise reduction are presented without analysis or discussion. A.R.H.

N79-25845*# Virginia Polytechnic Inst. and State Univ., Blacksburg.
AN ANALYTICAL AND EXPERIMENTAL STUDY OF SOUND PROPAGATION AND ATTENUATION IN VARIABLE-AREA DUCTS Final Report
A. H. Nayfeh, J. E. Kaiser, R. L. Marshall, and L. J. Hurst Oct. 1978 134 p refs
(Contract NAS3-18553)
(NASA-CR-135392) Avail: NTIS HC A07/MF A01 CSCL 20A

The performance of sound suppression techniques in ducts that produce refraction effects due to axial velocity gradients was evaluated. A computer code based on the method of multiple scales was used to calculate the influence of axial variations due to slow changes in the cross-sectional area as well as transverse gradients due to the wall boundary layers. An attempt was made to verify the analytical model through direct comparison of experimental and computational results and the analytical determination of the influence of axial gradients on optimum liner properties. However, the analytical studies were unable to examine the influence of non-parallel ducts on the optimum linear conditions. For liner properties not close to optimum, the analytical predictions and the experimental measurements were compared. The circumferential variations of pressure amplitudes and phases at several axial positions were examined in straight and variable-area ducts, hard-wall and lined sections with and without a mean flow. Reasonable agreement between the theoretical and experimental results was obtained. A.R.H.

N79-25846# Naval Postgraduate School, Monterey, Calif.
COMPARISON OF THEORETICAL AND EXPERIMENTAL SOUND RADIATION PATTERNS FROM A WATER LOADED FLEXURAL DISK TRANSDUCER M.S. Thesis
Tekin O. Kiyar Dec. 1978 110 p refs
(AD-A066388) Avail: NTIS HC A06/MF A01 CSCL 20/1

Measurements of the sound radiation patterns in water from the flexural vibrations of a clamped-edge steel disk have been made and are compared with the results of theoretical calculations for the two lowest order circularly symmetric modes of disk vibration. Although some differences were expected and were found due to the experimental condition which only approximated the assumptions made in the theory, it was found that the major features of the measured patterns agreed reasonably well with the theoretical patterns. The results have applicability to the design of sound source which could be used in underwater tracking of vehicles on a test range. GRA

N79-25847# Naval Weapons Center, China Lake, Calif.
ULTRASONIC DATA LINK MEASUREMENTS Final Report, Oct. 1977 - Sep. 1978
Myren L. Iverson Mar. 1979 35 p
(AD-A066510; NWC-TP-6094) Avail: NTIS HC A03/MF A01 CSCL 17/2

The ultrasonic data link concept described in this report will provide a link through a ships's structure between warning sensors and a ship's damage control center that is uninterruptible by fires or explosions. This concept is also compatible with other proposed data bus concepts and allows for graceful degradation. Included are the results of measurements made aboard Navy and Coast Guard ships of several important parameters that affect the ultrasonic data link performance. GRA

N79-25848# Naval Ocean Systems Center, San Diego, Calif.
THE EFFECT OF MASS LOADING ON A STIFFENING RIB
B. L. Woolley 1 Sep. 1978 30 p refs
(SF33341495)
(AD-A066614; NOSC/TR-286) Avail: NTIS HC A03/MF A01 CSCL 20/1

In the scattering of an acoustic wave incident upon a rib-reinforced plate, the effect of the rib can be characterized by a pair of impedances. One of these impedances is associated with the longitudinal vibrations of the rib, and the other impedance is associated with the flexural vibrations of the rib. This report calculates the impedances and the effect of mass loading on these impedances. The calculations are done for a thick or Timoshenko-Mindlin rib which is fluid loaded with the rib immersed either in water or air. Author (GRA)

N79-25849# Naval Postgraduate School, Monterey, Calif.
NEAR GRAZING SCATTERING BY SLIGHTLY ROUGH SURFACES M.S. Thesis
James Matthew Bailie Dec. 1978 112 p refs
(AD-A066365) Avail: NTIS HC A06/MF A01 CSCL 20/1

At the 95th meeting of the Acoustical Society of America (May 1978), I. Tolstoy outlined his application of a theory by M.A. Biot describing sound scatter from slightly rough surfaces at near-grazing incidence. This theory, using a boundary condition due to Biot (Biot 1968), is first order in the roughness parameter, rather than second order as other scattering theories: it includes multiple scatter and diffraction which other theories generally ignore: it does not involve the Kirchhoff Assumption which is particularly suspect at small grazing angles. For near-grazing forward scatter from a point source, the theory predicts that, in addition to a volume wave, coherent multiple Rayleigh scatter will generate a boundary wave in the fluid above the slightly rough rigid surface. At sufficient distances for near-grazing incidence it is predicted that the boundary wave will be greater than the direct or volume wave. The aim of this work, in general, is to compare Tolstoy's theory with experimental data. Author (GRA)

N79-25850# Stanford Univ., Calif. Edward L. Ginzton Lab.
ACOUSTICALLY SCANNED OPTICAL IMAGING DEVICES Semiannual Report, 1 Jul. - 31 Dec. 1978
G. S. Kino Feb. 1979 55 p refs
(Contract N00014-76-C-0129; ARPA Order 2778)
(AD-A066626; SU-GL-2923; SAR-7) Avail: NTIS HC A04/MF A01 CSCL 20/1

Our ZnO RF sputtering system has been tested more thoroughly in the last three months. We have succeeded in making high quality reproducible volume wave transducers with as good as and in some cases better characteristics than any we have made before. Deposition rates are a factor of six higher than in our previous system and a factor of two higher than the Japanese work. We believe, from our experience, that the deposition rate can be made still higher while at the same time obtaining better quality films. Experiments have been carried out depositiong ZnO on gold, on SiO2, on Si, and on quartz. All the layers look to be good quality. We have just begun to construct surface wave devices made with this technique. We anticipate that the results will be excellent and reproducible. GRA

N79-25851# Naval Postgraduate School, Monterey, Calif.
ELEMENTS OF SOUND TRANSMISSION IN BEAMS Final Report, 14 Apr. - 30 Sep. 1978
A. B. Coppens and O. B. Wilson, Jr. 30 Sep. 1978 35 p refs
(ZR0000101)
(AD-A066597; NPS61-79-004) Avail: NTIS HC A03/MF A01 CSCL 20/11

The elements of longitudinal and shear waves in solids are reviewed and applied to the propagation of sound in an I beam. Comparison with experimental data reveals that principle modes of vibration in an I beam excited under a number of different source placements seem to be dominated by the first flexural mode. A variety of source transducers were constructed for the efficient excitation of motion in the beams. Author (GRA)

N79-25852# Naval Postgraduate School, Monterey, Calif.
IMPULSE WAVE DIFFRACTION BY RIGID WEDGES AND PLATES M.S. Thesis
Joseph Henry Bremhorst Dec. 1978 114 p refs
(AD-A066476) Avail: NTIS HC A06/MF A01 CSCL 20/1

The problem of diffraction of acoustic signals by rigid barriers is studied empirically. Backward and forward diffraction from a 90 degree wedge and a thin plate are analyzed. Attempts to measure the diffracted energy in the illuminated region over the apex of the barrier, where direct and reflected signals coexist with diffracted, are discussed. Factors influencing the choice of the barriers: physical dimensions and composition are listed, as are the problems surrounding the selection of an ideal sound source and receiver. Finally, the data are compared to the theory by Biot and Tolstoy (Journal of the Acoustical Society of America, v. 29, 1957) and found to be in good agreement with predictions. Author (GRA)

N79-25853# Naval Postgraduate School, Monterey, Calif.
THEORETICAL STUDY OF FINITE AMPLITUDE STANDING WAVES IN RECTANGULAR CAVITIES WITH PERTURBED BOUNDARIES M.S. Thesis
Mehmet Aydin Dec. 1978 61 p refs
(AD-A066356) Avail: NTIS HC A04/MF A01 CSCL 20/1

The effects of various geometrical boundary perturbations on finite-amplitude acoustical standing waves in a rectangular, rigid-walled cavity were investigated using non-linear theory. The standing waves that exist in an ideal cavity must be corrected when the boundaries are irregular. Three specific examples (stepped, linear and wedged perturbations) were worked out to demonstrate the corrections (in first order) near degeneracies for small perturbations. Those specific examples were compared to the experiments. The present theoretical model qualitatively predicts the effect of the perturbations on the behavior of the nonlinearly generated second harmonic. However, there are unexplained quantitative discrepancies between experiment and theory for a couple of cases. Author (GRA)

N79-25854# Battelle Columbus Labs., Ohio.
A PROCEDURE FOR OBTAINING MORE ACCURATE TIMING INFORMATION FOR THE SOUND RANGING PROBLEM
Lonnie C. Ludeman Feb. 1979 23 p refs
(Contract DAAG29-76-D-0100; DA Proj. 1L1-61102-B-53A) (AD-A066995; ERADCOM/ASL-CR-79-0100-1) Avail: NTIS HC A02/MF A01 CSCL 20/1

A model for the sound ranging problem is formulated and simplified. A procedure is then given for obtaining more accurate timing information from the received microphone signals. The procedure described consists of four basic parts: (1) a prefiltering operation, (2) a pair by pair correlation, (3) an elimination of inaccurate data, and (4) an overall least square time fit. Author (GRA)

N79-25855# Naval Research Lab., Washington, D. C.
THERMOSPHERIC PROPAGATION OF SONIC BOOMS FROM THE CONCORDE SUPERSONIC TRANSPORT Final Report
John H. Gardner and Peter H. Rogers 14 Feb. 1979 83 p refs
(AD-A067201; NRL-MR-3904) Avail: NTIS HC A05/MF A01 CSCL 20/1

A nonlinear theory for the long-range propagation of sonic booms through the thermosphere has been developed. A realistic atmosphere is employed, and consideration is given to such factors as nonlinear stretching and decay of the wave, the effects of the caustic, the linear acoustic attenuation, and the increase in Mach number due to the decreasing density at high altitudes. Detailed results are presented for the case of the I Concorde SST in straight, level and steady flight at 17.5 km and a velocity of Mach 2. We predict maximum ground level pressures of 0.3 Pa with an N-wave period of about 10 seconds. The sound level is a minimum along the flight track with the maximum signal strength occurring about 300 km off the flight track. The strongest received signal travels initially downward and reflects off the surface of the ocean to thermosphere. The wave turns around at an altitude of 160 km and is returned back to the ground at a horizontal distance of 320 km from the launch point. The acoustic Mach number of the wave never exceeds 0.2. Ninety percent of the wave's energy is attenuated below 100 km with 99% attenuated by the time the wave reaches the turning point. GRA

N79-25856# Grenoble Univ. (France). Centre d'Etude des Phenomenes Aleatoires et Geophysiques.
ACOUSTIC IMAGERY OF PIN-POINT SOURCES AND RESOLUTION OF SOURCES EXHIBITING SLIGHT SEPARATION [IMAGERIE ACOUSTIQUE DE SOURCES PONCTUELLES. RESOLUTION DE SOURCES RAPPROCHEES]
J. Munier 9 Sep. 1977 15 p refs In FRENCH Presented at EUROMECH 94th Colloq., Marseille, 12-15 Sep. 1977
(CEPHAG-42/77) Avail: NTIS HC A02/MF A01

An algebraic method for numeric resolution, using the normalized interspectral density measurement of signals received by three pickups or groups of pickups, makes possible the identification of two distant pinpoint sources. The method is given in terms of establishing the direction of sources and evaluating their relative intensities. In comparison with classical methods of source determination using directional antennas (preformed channels for SONAR) or by variable baseline interferometry, a substantial gain in separation is obtained if the precision of the measurement is sufficient. Noncorrelated sources (incoherent imagery) are assumed for the purposes of this discussion. Author (ESA)

N79-25857# Grenoble Univ. (France). Centre d'Etude des Phenomenes Aleatoires et Geophysiques.
DETERMINATION OF CHARACTERISTICS OR REAL MEDIUM (TWO MOVING OBJECTS) USING COMPLEX DEMODULATION AND ADAPTIVE FILTERING FROM PSK TYPE EMISSION BxT = 128 [DETERMINATION DES CARACTERISTIC D'UN MILIEU REEL (COMPOSE DE DEUX MOBILES) OBTENUE PAR DEMODULATION COMPLEXE ET FILTRAGE ADAPTE A PARTIR D'UNE EMISSION DU TYPE PSK DE BxT = 128]
B. Faure 21 Oct. 1977 43 p In FRENCH
(CEPHAG-47/77) Avail: NTIS HC A03/MF A01

Characterization of two moving targets in a tank by means of analysis of a pass-band emission of a given product BxT was investigated. Different phases of data processing are described and experimental results are compared to theoretical predictions. An applied method theory was developed to study a mathematical model of the same problem. Results are in agreement with the expected theoretical values, that is two wires 1 cm apart can be distinguished as well as obstacles having a difference in relative speed of 15 cm/sec. Author (ESA)

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N79-25858 Boston Univ., Mass.
EXCHANGE POTENTIALS FOR CONTINUUM ELECTRON-MOLECULE INTERACTIONS Ph.D. Thesis
Jonathan Marks Siegel 1979 87 p
Avail: Univ. Microfilms Order No. 7912166

The continuum multiple-scattering model (CMSM) provides a calculationally efficient yet physically appropriate representation of single-particle aspects of continuum electron-molecule interactions. Initial applications of the CMSM, however, experienced difficulties because the Slater Xalpha potential used could not represent in a straightforward manner the interaction of a continuum electron with a set of N bound electrons, nor could it reflect the energy-dependent nature of the continuum exchange interaction. To remedy this difficulty several direct approximations to continuum exchange are examined. The Hara free-electron gas (HFEGE) approximation is singled out as the most likely choice for implementation with the CMSM. Availability of a direct approximation to exchange makes possible calculation in the so-called static-exchange-polarization framework in which these dominant components to the potential can be specified separately. Dissert. Abstr.

N79-25859 California Univ., Santa Cruz.
ELECTRONIC EXCITATION OF ALKALI ATOMS BY DIATOMIC MOLECULES: NEAR THRESHOLD DIFFERENTIAL CROSS SECTIONS Ph.D. Thesis
Jim Warner 1978 333 p
Avail: Univ. Microfilms Order No. 7911946

Individual vibrational transitions were resolved in the energy loss spectra of Rb(5S-2) undergoing electronic excitation to the 5P-2 resonance state after scattering by N2. Time of flight measurements at center of mass energies of 1000, 2000 and 3000 cm above the electronic excitation energy were made at lab angles from 35 to 85 deg to construct flux contour maps in velocity-angle space. The maps show that inelastically scattered Rb appears primarily forward in the center of mass. The residual energy after Rb electronic and N2 vibrational excitation is distributed approximately equally between product translation and N2 rotation. At 2000/cm above the electronic threshold Rb+CO

failed to show a similar inelastic peak. For both CO and N2 unresolved T - V energy transfer is observed as an asymmetry in the elastic scattering at wide angles. Dissert. Abstr.

N79-25860 Minnesota Univ., Minneapolis.
PRESSURE EFFECTS ON MOLECULAR RYDBERG STATES Ph.D. Thesis
Larry Ray Wilson 1978 180 p
Avail: Univ. Microfilms Order No. 7912104

The shifts of the absorption bands to a number of molecule Rydberg states is studied. These shifts were produced by the application of high pressures of inert, transparent gases. The systems studied are the A(3s) state of ammonia perturbed by He, N2 and Ar from 10 to 150 atm., Ne and CH4 from 10 to 70 atm., CF4 from 10 to 40 atm. and SF6 from 10 to 25 atm., and Rydberg states in the following molecules perturbed by from 10 to 150 atm. of Ar and He: nitric oxide, ethylene, benzene, methyl iodide and ethane. In general, the shift of a higher Rydberg state is found to be relatively insensitive to the exact identity of the core. Argon red shifts molecular Rydberg states over the density range studied and He blue shifts molecular Rydberg states. It is found that for higher Rydberg states, the Rydberg electron and the core can be treated individually, in contrast to the interaction between a perturbing species and a very low-lying Rydberg state. Dissert. Abstr.

N79-25861*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
ELECTRICAL ENCLOSURE HYDROGEN INTRUSION STUDY
Peter J. Welch and John N. Yantsios Jun. 1979 34 p refs
(NASA-TP-1461; KSC-TR-72-1) Avail: NTIS HC A03/MF A01 CSCL 21B

As a cost savings measure for the space shuttle program, the feasibility of substituting dry air for nitrogen as the purge gas used to minimize the probability of fire and explosions which could erupt from propellant vapor (hydrogen) diffusion into the electrical enclosures at Launch Complex 39 was investigated. It was concluded that: (1) Hydrogen concentrations of approximately 1% were obtained in an electrical enclosure under design purge conditions. (2) Hydrogen concentrations exceeding the lower explosive limit, 4%, could probably be obtained within the enclosure under worst case conditions. (3) Most of the hydrogen intrusion into the enclosure probably occurred at the point with the shortest leak path, such as the door seal. (4) More stringent electrical enclosure design requirements should be imposed before air is using as a purge gas. A.R.H.

N79-25862# Michigan Univ., Ann Arbor. Dept. of Physics.
NONLINEAR OPTICAL POLARIZABILITIES OF MOLECULES Ph.D. Thesis. Interim Report
Charles Kenneth Miller Jan. 1978 138 p refs
(Grant AF-AFOSR-3225-77; AF Proj. 2301)
(AD-A066726; AFOSR-79-0365TR) Avail: NTIS HC A07/MF A01 CSCL 20/3

A review is given of the relation between microscopic and macroscopic forms of electric tensor properties of both second and third orders. The Second Harmonic Generation process in a focused laser beam for a particular dc field geometry is also reviewed, and the treatment is extended to include anomalously dispersive gases. Hyperpolarizabilities and hyperpolarizability ratios have been measured for the molecules H2, N2, O2, CO, NO, CO2, SF6, NH3, H2S, H2O, (CH3) 2O, and CH3OH. The results are presented and compared with theoretical and experimental data from other sources. Agreement with most other gas-phase experimental data is good, and where this is not the case, we believe our data to be the more reliable. Special points of interest are discussed for several of the molecules. Author (GRA)

N79-25863# Washington Univ., Seattle. Dept. of Chemistry.
COLLISIONAL RELAXATION OF NON-EQUILIBRIUM VIBRATION ENERGY DISTRIBUTIONS IN A THERMAL UNIMOLECULAR SYSTEM: SURFACE COLLISIONS
D. F. Kelley, B. D. Barton, L. Zalotai, and B. S. Rabinovitch 15 Mar. 1979 9 p refs
(Contract N00014-75-C-0690)
(AD-A066707; NR092-549-TR09) Avail: NTIS HC A02/MF A01 CSCL 07/4

Measurements are made for the first time (on cyclopropane) of the dynamics of collisional relaxation of vibrational distributions of reacting molecules at high energies, and at high temperatures. This is the same as the determination of the mean first passage time tau of molecules with respect to an absorbing barrier. A simple technqiue, called the Variable Encounter Method has been devised for this purpose. Author (GRA)

N79-25864# Harvard Univ., Cambridge, Mass. Dept. of Physics.
TRAPPED ION RESEARCH Final Report, 1 Aug. 1977 - 31 Jul. 1978
Norman F. Ramsey and Daniel J. Larson 3 Apr. 1979 36 p refs
(Contract N00014-77-C-0547)
(AD-A067365) Avail: NTIS HC A03/MF A01 CSCL 07/4

The trapped ion apparatus has been assembled during the past year and successfully used to study the photodetachment of S(-) ions. A periodic dependence of the photodetachment cross section on the light frequency was observed for the first time in any atom. The oscillatory structure could be attributed to the excitation of the detached electrons to discrete cyclotron levels in the magnetic field. The experiments so far also indicate that state dependent photodetachment should provide an effective means for producing and detecting population differences in trapped ions. Author (GRA)

N79-25865# National Physical Lab., Teddington (England). Div. of Mechanical and Optical Metrology.
PARTICLE SCATTERING FROM A SURFACE WITH REGULAR, ONE-DIMENSIONAL ROUGHNESS ELEMENTS
R. E. Shawyer and G. N. Peggs Mar. 1978 19 p refs
(NPL-MOM-30) Avail: NTIS HC A02/MF A01

An analytic method is presented for determining the spatial distribution of particles scattered, according to a diffuse scattering law, from a surface with roughness elements in a regular array of triangular grooves. The spatial distributions of particles interacting once, twice, and three times with the surface are evaluated and the fraction of particles performing multiple surface interactions of a specific order calculated. The results of these are compared in detail with a computer simulated experiment of known accuracy which serves to illustrate the range of groove angles and beam incidence angles over which the analytical approach can be usefully employed. Finally, a comparison with results obtained from molecular beam scattering experiments is made. Author (ESA)

N79-25071*# Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn (West Germany).
MOLECULAR CONTAMINATION STUDIES BY MOLECULAR BEAM SCATTERING
H. Nuss *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 657-681 refs (For primary document see N79-25048 16-12)
HC A99/MF A01 CSCL 20H

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N79-25866 Oregon Univ., Eugene.
A SURVEY OF RESONANCES NEAR (p,n) REACTION THRESHOLDS Ph.D. Thesis
Edward Wallace Ross 1978 138 p
Avail: Univ. Microfilms Order No. 7912585

Resonances near (p,n) reaction thresholds were studied with high resolution by measuring the energy spectrum of the emitted neutrons by the time of flight technique. The resonances are resonances of the compound nucleus formed from the interaction of a proton with the target nucleus. A study of kinematics near threshold shows that low energy neutrons are emitted at small forward angles in the laboratory, allowing one to observe weak

narrow resonances with good resolution. Approximately 35 thresholds were surveyed using targets with mass numbers from A=26 to A=89. Dissert. Abstr.

N79-25867 Illinois Univ. at Urbana-Champaign.
A VARIATIONAL THEORY OF NUCLEAR MATTER Ph.D. Thesis
Robert Bruce Wiringa 1978 139 p
Avail: Univ. Microfilms Order No. 7913660

The variational theory is developed, starting with the choice of wave function. A generalized Jastrow product of two-body correlation functions containing central, spin, isospin, tensor, and spin-orbit operators is used. The correlation function is generated by a series of two-body Schroedinger equations with boundary conditions which require the wave function to heal at a distance d. Diagram rules are given and a general diagrammatic cluster expansion is derived. Large classes of diagrams contributing to an expectation value can be summed by means of integral equations. The development of single chain, hypernetted chain, and Fermi hypernetted chain (FHNC) equations for central correlations is reviewed. The chain summation methods are extended to sum single operator chains (SOC) for the noncentral operators. The energy expectation value for potentials with six operators are evaluated using the FHNC/SOC functions, with an exact treatment of the commutators involved. The energy is found to have a minimum with respect to variations in all parameters. Dissert. Abstr.

N79-25868*# Pennsylvania State Univ., University Park. Dept. of Electrical Engineering.
MAPPING OF ELECTRICAL POTENTIAL DISTRIBUTION WITH CHARGED PARTICLE BEAMS Semiannual Report, Nov. 1978 - May 1979
James W. Robinson Jun. 1979 37 p refs
(Grant NsG-3166)
(NASA-CR-158713) Avail: NTIS HC A03/MF A01 CSCL 20H

Potentials were measured using a beam of soft X-rays in air at 2 x 10 to the -5 power Torr. Ions were detected by a continuous-dynode electron multiplier after they passed through a retarding field. Ultimate resolution depends upon the diameter of the X-ray beam which was 3 mm. When the fields in the region of interest were such to disperse the ions, only a small fraction were detected and the method of measurement was not very reliable. Yet reasonable data could be collected if the ions traveled in parallel paths toward the detector. Development should concentrate on increasing the aperture of the detector from the pinhole which was used to something measured in centimeters. Also increasing the strength of the source would provide a stronger signal and more reliable data. Measurements were made at an estimated ion current to 10 to the -15 power A from a 10 cm length of the X-ray beam, this current being several orders of magnitude below what would have a perturbing effect on the region to be measured. Consequently, the source strength can be increased and prospects for this method of measurement are good. A.R.H.

N79-25869*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THERMAL CONTROL OF HIGH ENERGY NUCLEAR WASTE, SPACE OPTION
Jerry A. Peoples May 1979 45 p
(NASA-TM-78300) Avail: NTIS HC A03/MF A01 CSCL 18G

Problems related to the temperature and packaging of nuclear waste material for disposal in space are explored. An approach is suggested for solving both problems with emphasis on high energy density waste material. A passive cooling concept is presented which utilized conduction rods that penetrate the inner core. Data are presented to illustrate the effectiveness of the rods and the limit of their capability. A computerized thermal model is discussed and developed for the cooling concept. A.R.H.

N79-25870# Argonne National Lab., Ill.
PHYSICS OF REACTOR SAFETY Quarterly Report, Apr. 1978 - Jun. 1978
Apr. 1979 90 p refs
(Contracts NRC-FIN-A-201; NRC-FIN-A-2018; NRC-FIN-A-2045; DOE-40-550-75)
(PB-293348/9; ANL-78-85; NUREG-CR-0477) Avail: NTIS HC A05/MF A01 CSCL 18I

Work done in Argonne National Laboratory's Applied Physics Division and Components Technology Division for the U.S. Nuclear Regulatory Commission during the months of April-June 1978 is summarized. The work in the Applied Physics Division includes reports on reactor safety program by members of the Reactor Safety Appraisals Group, Monte Carlo analysis of safety-related critical assembly experiments by members of the Theortical Fast Reactor Physics Group, and Planning of Safety-Related (ZPR) Planning and Experiments Group. Work on reactor core thermal-hydraulic code development performed in the Components Technology Division is also included. GRA

74 OPTICS

Includes light phenomena.

N79-25871 Stanford Univ., Calif.
OPTICAL PARAMETRIC AMPLIFICATION Ph.D. Thesis
Richard Albert Baumgartner 1979 126 p
Avail: Univ. Microfilms Order No. 7912338

A theoretical description of parametric amplification for the interaction of three waves in a nonlinear dielectric is derived. Experimental results for a crystal of KD*P are compared with the theoretical derivations. Demonstration of significant gain and pump depletion are shown for amplification experiments in LiNbO3. Parametric oscillation with a pulsed laser puming source is discussed with emphasis on the significance of cavity length and optical element transmission on oscillator threshold. Laser technology was applied to the remote monitoring of air pollutants. A parametric amplifier and oscillator, using LiNbO3 as the nonlinear medium with a Nd:YAG pumping laser, provided a high peak power tunable infrared radiation source. This source was used to monitor the presence of pollutant gases in the atmosphere, using the vibrational infrared absorption of the gases. The experimental system and measurement results are discused. Dissert. Abstr.

N79-25872*# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Labs.
RESEARCH ON SPECTROSCOPIC IMAGING. VOLUME 1: TECHNICAL DISCUSSION
Alan Title and William Rosenberg Apr. 1979 207 p refs
(Contract NASw-3107)
(NASA-CR-158702; LMSC-D674593-Vol-1) Avail: NTIS HC A10/MF A01 CSCL 20F

The principals of operation and the capabilities of birefringent filters systems are examined. Topics covered include: Lyot, Solc, and partial polarizer filters; transmission profile management; tuning birefringent filters; field of view; bandpass control; engineering considerations; and recommendations. Improvements for field of view effects, and the development of birefringent filters for spaceflight are discussed in appendices. A.R.H.

N79-25873*# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Labs.
RESEARCH ON SPECTROSCOPIC IMAGING. VOLUME 2: REFERENCE LITERATURE
Alan Title and William Rosenberg Apr. 1979 261 p refs
(Contract NASw-3107)
(NASA-CR-158703; LMSC-D674593-Vol-2) Avail: NTIS HC A12/MF A01 CSCL 20F

Translations of scientific papers on birefringent filters by Lyot and Solc are presented along with the texts of 15 recent treaties on filter techniques. A.R.H.

N79-25874*# Battelle Columbus Labs., Ohio.
STUDY OF METHODS FOR DIRECT OPTICAL ADDRESS OF INTEGRATED OPTICAL CIRCUITS
V. E. Wood and C. M. Verber Jun. 1979 62 p refs
(Contract NAS1-15315)
(NASA-CR-159054) Avail: NTIS HC A04/MF A01 CSCL 20F

Methods for introducing optical information directly, without intervening recording and storage steps, into integrated optical data-processing devices are surveyed. The information is taken to be in the form of a one-dimensional variation of intensity across the beam. Physical phenomena that may be utilized are evaluated, and the most suitable presently known classes of materials for exploitation of each type of interaction are discussed. A variety of possible device configurations are suggested and general principles are outlined whereby many more device types can be generated. A simple experimental device was demonstrated and its operation was analyzed. Author

N79-25875*# Lockheed Electronics Co., Houston, Tex.
OPTICAL DEVICES FOR PROXIMITY OPERATIONS STUDY AND TEST REPORT
R. A. Smith Apr. 1979 43 p
(Contract NAS9-15800)
(NASA-CR-160179; LEC-13203; IN-79-EH-03; JSC-14747) Avail: NTIS HC A03/MF A01 CSCL 20F

Operational and physical requirements were investigated for a low-light-level viewing device to be used as a window-mounted optical sight for crew use in the pointing, navigating, stationkeeping, and docking of space vehicles to support space station operations and the assembly of large structures in space. A suitable prototype, obtained from a commercial vendor, was subjected to limited tests to determine the potential effectiveness of a proximity optical device in spacecraft operations. The constructional features of the device are discussed as well as concepts for its use. Tests results show that a proximity optical device is capable of performing low-light-level viewing services and will enhance manned spacecraft operations. A.R.H.

N79-25876*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ROTARY TARGET V-BLOCK Patent Application
Charlton W. Mann, inventor (to NASA) Filed 17 Apr. 1979 12 p
(NASA-Case-LAR-12007-2; US-Patent-Appl-SN-030964) Avail: NTIS HC A02/MF A01 CSCL 20F

A device is disclosed for measuring the distance from a reference plane to a flat or cylindrical surface. The device contains a rotatable measuring scale which is sited with an optical instrument to make the measurement. Readings are taken at various points along the surface to establish an elevation curve which is used to align the surface with the reference plane. NASA

N79-25877# California Univ., Berkeley. Lawrence Berkeley Lab.
Ge:Ga PHOTOCONDUCTORS IN LOW INFRARED BACKGROUNDS
E. E. Haller, M. R. Hueschen, and P. L. Richards 29 Jan. 1979 12 p refs
(Contract N00014-75-C-0496)
(AD-A066625; LBL-8504) Avail: NTIS HC A02/MF A01 CSCL 17/5

Photon noise limited performance of photoconductive detectors made from gallium doped germanium in very low infrared backgrounds (less than or equal to ten to the minus 8th power incident photons per second) is reported in this report. These detectors were made from a large volume crystal of Ge:Ga of the quality used for lithium drifted germanium gamma-ray spectrometers. This material contained very low concentrations of deep traps and minority impurities (mainly phosphorus). These conditions were made possible by the use of high purity Ge crystal growing equipment. GRA

N79-25878# Optical Sciences Co., Placentia, Calif.
ANALYSIS OF TECHNIQUES FOR IMAGING THROUGH THE ATMOSPHERE Interim Report, Apr. 1978 - Oct. 1978
David L. Fried Griffiss AFB, N. Y. RADC Jan. 1979 79 p refs
(Contract F30602-77-C-0021; ARPA Order 2646; AF Proj. 2646)
(AD-A066598; DR-124; RADC-TR-78-285; IR-4) Avail: NTIS HC A05/MF A01 CSCL 09/4

A detailed analysis of turbulence effects in speckle interferometry, i.e., the Labeyrie technique, and in speckle imagery, the Knox-Thompson algorithm, is presented. Particular concern is devoted to the problem of isoplanatism, as originally we had thought that the Knox-Thompson algorithm might have a very large isoplanatic field-of-view. Our analytic results show the isoplanatic patch size is approximately the same for Knox-Thompson and Labeyrie methods, and nearly the same as for adaptive optics. It is noted that, unlike the adaptive optics systems for which the ability to record high spatial frequency details is lost due to anisoplanatism, for the speckle methods anisoplanatism does not suppress the high spatial frequency details of the image - it merely jumbles them so that no real information is developed. From these results, it appears that a direct application of speckle techniques will not provide a significant relief from the anisoplanatism problems of adaptive optics. As part of the analysis of the Knox-Thompson method, we develop the conditions for the allowable spatial frequency separation, something done previously only by simulation. We find that the allowable spatial frequency separation should be less than 0.427 r sub 0/lambda, and preferably should be less than 0.2 r sub 0/lambda. GRA

N79-25879# Naval Postgraduate School, Monterey, Calif.
A SERIAL FIBER OPTIC DATA BUS FOR A DISTRIBUTED MICROCOMPUTER SYSTEM M.S. Thesis
Richard Ernest Schue Sep. 1978 197 p refs
(AD-A066612) Avail: NTIS HC A09/MF A01 CSCL 20/6

The design and development of a serial fiber optic data bus to connect several Intel single board computers in a distributed processing system is described in this thesis. Included are details on the serial bus control and message handling techniques developed for the system. Also included is a complete description of the hardware that was constructed. Commercially available fiber optic components were used in the data bus. The interface software is compatible with a real-time operating system previously developed at the Naval Postgraduate School. Author (GRA)

N79-25880# Naval Ocean Systems Center, San Diego, Calif.
EVALUATION OF MULTIPORT SINGLE-FIBER FIBER-OPTIC COUPLERS Test and Evaluation Report, 1 Aug. 1978 - 30 Oct. 1978
T. A. Meador 1 Feb. 1979 11 p refs
(AD-A066878; NOSC/TR-368) Avail: NTIS HC A02/MF A01 CSCL 20/6

This report evaluates the performance of multiport fiber-optic couplers designed for use with single-fiber cables in data-bus systems. The effort was part of the Fiber-Optic Device Technology Program, the purposes of which are to develop and evaluate the feasibility and practicability of Naval fiber-optic technology. Author (GRA)

N79-25881# Analytic Sciences Corp., Reading, Mass.
ADVANCED ADAPTIVE OPTICS CONTROL TECHNIQUES Final Report
Douglas P. Glasson and Deb K. Guha Jan. 1979 130 p refs
(Contract F29601-77-C-0017; AF Proj. 3326)
(AD-A066929; AD-E200260; TASC-TR-996-1; AFWL-TR-78-8) Avail: NTIS HC A07/MF A01 CSCL 20/5

Optimal estimation and control methods for high energy laser adaptive optics systems are described. Three system types are examined: Active Multidither (AMD), Phase Conjugate (PC), and Beam Cleanup (BC). Sources of phasefront distortion considered include: atmospheric turbulence, backscatter speckle, base vibration, and mirror thermal distortion. Kalman-type digital algorithms for phasefront aberration estimation are developed and evaluated through computer simulation; performance comparisons with classical estimation approaches are provided. Optimal feedback-feedforward controllers are designed for the active system components; performance comparisons with classical designs and sensivitiy studies related to disturbance model mismatches and active component bandwidth are presented. Results of integrated estimation and control simulations are evaluated. Areas for further refinement of the adaptive optics approaches and potential system implementations are recommended. Author (GRA)

N79-25882# Thomson-CSF, Meudon-la-Foret (France). Div. Faisceaux Hertziens.
STUDY OF THE POTENTIAL USE OF INTEGRATED AND

FIBER OPTICS IN SPACE Final Report
J. C. Anne, M. Triboulet, L. Dauria, C. Puech, and M. Papuchon Paris ESA Jul. 1978 315 p refs
(Contract ESTEC-3311/77-NL-PP(SC))
(ESA-CR(P)-1144; Rept-130) Avail: NTIS HC A15/MF A01

An evaluation of the potential uses of optical technologies for data handling and routing on board spacecraft is presented. The study was limited to fiber optics technology including light sources, fibers, and light detectors as well as to all known types of integrated optics devices. A glossary of optics technology terms and applications related specific terms is also included. Prospective applications described by the study are low rate data buses, high speed data transmission, RF filtering, data switching, analog data conditioning, logic data processing, RF modulation, and isolated applications. It is shown that the most promising applications at present are in the field of data buses (low or high rates), data switching, and analog data conditioning. Author (ESA)

N79-25079*# Air Force Geophysics Lab., Hanscom AFB, Mass.
AFGL INFRARED SURVEY EXPERIMENTS CLEANING PROCEDURE
Charles V. Cunniff *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 880-898 refs (For primary document see N79-25048 16-12)
Avail: NTIS HC A99/MF A01 CSCL 20F

N79-25081*# Aerojet Electrosystems Co., Azusa, Calif.
THE 2ND SURFACE MIRROR CLEANING AND VERIFICATION
M. K. Barsh *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 927-944 refs (For primary document see N79-25048 16-12)
Avail: NTIS HC A99/MF A01 CSCL 20F

N79-25086*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SILVER-TEFLON CONTAMINATION UV RADIATION STUDY
J. A. Muscari (Martin Marietta Aerospace) and S. Jacobs *In* AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1978 p 1112-1127 refs (For primary document see N79-25048 16-12)
(Contract NAS9-15436)
Avail: NTIS HC A99/MF A01 CSCL 20F

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N79-25883# Nagoya Univ. (Japan). Inst. of Plasma Physics.
QUANTUM EFFECTS ON THE TEMPERATURE RELAXATION IN PLASMAS
Kazuo Sakai and Osamu Aono Mar. 1979 26 p refs
(IPPJ-375) Avail: NTIS HC A03/MF A01

The rate of equilibration of difference between the ion and electron temperatures is obtained on the basis of the unified theory, in which the collective and binary interactions are both treated properly. The electrons obey the Fermi distribution of arbitrary degeneracy. The rate decreases owing to the degeneracy. Even in the nondegenerated case, the quantum effect appeared in the argument of the Coulomb logarithm. When the de Broglie wave length of the electron is much longer than the radius of close collision, the results agree with those obtained on the Born approximation. In the opposite limit, the classical theory applies. For other cases, graphical examples are given. Author

N79-25884# Nagoya Univ. (Japan). Inst. of Plasma Physics.
ANALYSIS OF ION BEAM EXTRACTED FROM REFLEX TETRODE
Shigeo Kawata, Takashi Abe, Koichi Kasuya, and Keishiro Niu Mar. 1979 20 p refs
(IPPJ-377) Avail: NTIS HC A02/MF A01

It is shown that the ion beam is forced to move from the anode toward the virtual cathode in a reflex tetrode which is made on the basis of a new idea that the plasma source is separated from the anode. The expressions are derived for the ion-beam current densities which are extracted from reflex tetrodes. Two types of tetrodes are considered, one of which has the ion source and the other the plasma source. The analyses are given for the three kinds of geometries, plane, cylindrical and spherical. Author

N79-25885# Nagoya Univ. (Japan). Inst. of Plasma Physics.
SHAPING OF FERROMAGNETIC WALL FOR LINKED MINIMUM-B CONFIGURATION
K. Ikuta Mar. 1979 15 p refs
(IPPJ-378) Avail: NTIS HC A02/MF A01

A possibility to form a linked minimum-B configuration by the use of ferromagnetic materials was studied analytically. In particular, both l=2 and l=3 cases were investigated in detail. By arrangement of the helically modulated, bumpy wall in a periodical array, the linked minimum-B system was able to be constructed. A typical case of wall arrangement is also illustrated. Author

N79-25886# Nagoya Univ. (Japan). Inst. of Plasma Physics.
CHARGE STATE DISTRIBUTION OF MULTIPLY-CHARGED IONS EXTRACTED FROM ECR-PLASMA
A. Matsumoto, S. Aihara, S. Ohtani, K. Okuno, S. Tsurubuchi, T. Iwai, and Y. Kaneko 3 Apr. 1979 21 p refs
(IPPJ-380) Avail: NTIS HC A02/MF A01

An ion source based on the ECR (electron cyclotron resonance) heating in a magnetic bottle was developed in order to apply it to atomic collision experiments. Extracted ions were observed up to Ar(8+) and N(5+). From the charge state distribution observed, the confinement time of ions is estimated for each charge state. G.Y.

N79-25887# Naval Research Lab., Washington, D. C.
PLASMA DIFFUSION IN A SPACE-SIMULATION BEAM-PLASMA DISCHARGE Interim Report
E. P. Szuszczewicz, D. N. Walker, J. C. Holmes, and H. Leinbach 12 Feb. 1979 19 p refs
(RR0330244)
(AD-A066922; AD-E000276; NRL-MR-3925) Avail: NTIS HC A02/MF A01 CSCL 20/9

Electron density and temperature profiles have been measured in a large-facility beam-plasma-discharge(V sub B = 1.3 KeV, I sub B = 63 ma) at low pressure (P = 2-4(10 to the -6th power)Torr) and low magnetic fields (B = 1.2 G). The results follow an exponential behavior and are found to be in good agreement with a simple diffusion model. The favorable comparison between theory and experiment yields the first estimate of cross-field electron diffusion (perpendicular diffusion coefficient (nom) = 2.2 million sq cm/sec) under conditions intended to simulate Spacelab-borne beam-plasma investigations. This value for perpendicular diffusion coefficient is orders of magnitude larger than would be expected for a cross-field collisional diffusion process, a result which is identified with the turbulent state of collective beam-plasma interactions. GRA

N79-25888# California Univ., Los Angeles. School of Engineering and Applied Science.
STUDIES OF NONLINEAR PHENOMENA IN HIGH-TEMPERATURE PLASMAS Final Technical Report, 1 Jan. 1974 - 31 Dec. 1978
P. K. C. Wang Dec. 1978 28 p refs
(Grant AF-AFOSR-2662-74)
(AD-A066725; UCLA-ENG-7896; AFOSR-79-0367TR) Avail: NTIS HC A03/MF A01 CSCL 20/9

This report summarizes the results of a study on various nonlinear phenomena in high-temperature plasmas; in particular, explosive instabilities and wave-energy transfer in nonlinear plasmas, turbulence, numerical solution of nonlinear equations in plasma physics, plasma heating by neutral injection, feedback stabilization and control of high-temperature plasmas.
Author (GRA)

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N79-25889 Rensselaer Polytechnic Inst., Troy, N. Y.
SELENIUM, ITS THERMODYNAMIC PROPERTIES AND VAPOR-PHASE CRYSTAL GROWTH Ph.D. Thesis
Hua-Cheng Shu 1979 226 p
Avail: Univ. Microfilms Order No. 7913086

Best data of heat capacities of trigonal crystalline, monoclinic crystalline, glassy amorphous and liquid selenium were obtained by assembling and critically evaluating available literature data and measurements on monoclinic Se and liquid Se. Functions representing the best heat capacity data were produced by least squares curve fitting of the best C sub p data. Thermodynamic quantities (H,S,G,etc.) were then calculated by computer numerical integration of the best data functions. Trigonal Se single crystals were grown isothermally and in a temperature-gradient from the vapor phase. Kinetic studies of crystallization and melting, thermal analysis (DSC, DTA), X-ray diffraction and electron and optical microscopy were carried out. Dissert. Abstr.

N79-25890 Minnesota Univ., Minneapolis.
INVESTIGATIONS OF AMORPHOUS Gd-Co AND Gd-Fe ALLOY THIN FILMS Ph.D. Thesis
Hardayal Singh Gill 1978 201 p
Avail: Univ. Microfilms Order No. 7912005

The magnetic properties of amorphous Gd-Co and Gd-Fe alloy thin films were investigated with emphasis on determining the sources of the magnetic anisotropy. Experimental information related to magnetic anisotropy was obtained from magnetic domain patterns, rotational hysteresis, magnetization and Hall effect loops; and a torque magnetometer. The effects of the amorphous structure, composition, thickness and preparation conditions on magnetic anistropy were correlated with information obtained using Auger electron spectroscopy and electron microscopy. The results of these experiments were used to construct a theoretical description of magnetic anisotropy in amorphous Gd-Co and Gd-Fe alloy thin films. Dissert. Abstr.

N79-25891 City Univ. of New York.
A MICROSCOPIC FRACTURE STUDY IN THE TWO DIMENSIONAL TRIANGULAR LATTICE Ph.D. Thesis
Adel Youssef Gohar 1979 283 p
Avail: Univ. Microfilms Order No. 7913128

The occurrence of fracture by crack propagation was investigated in this two dimensional triangular lattice by introducing cuts in rectangular samples subjected to uniaxial tension. Crack statistics were also investigated. A Lennard-Jones potential was used to describe the interaction between the atoms. The Griffith theory was examined. A propagation in which the strain energy remaines fairly constant is examined and dynamic and static stress profiles around crack tips are compared. Lattice trapping theory was tested. For this long ranged potential no trapping was found. It is possible to estimate initial crack velocities from the forces acting on the tip atoms after the cutting process. An interesting consequence of the discreteness of the lattice was observed near the critical point. The curve of tip stresses vs. applied loads loses the monotonic appearance and flattens out. Dissert. Abstr.

N79-25892 Iowa Univ., Iowa City.
MAGNETIC SUSCEPTIBILITY STUDY OF THE ALLOY SYSTEM SmP SUB x S SUB 1 MINUS x Ph.D. Thesis
Dennis Charles Henry 1978 167 p
Avail: Univ. Microfilms Order No. 7912854

A series of alloy samples are prepared from compressed powders of pure SmS and SmP. The magnetic susceptibilities of alloy samples in the concentration range 0.03 = or < x = or <.40 measured over the temperature range 1.6 to 300 K. Lattice parameter measurements at room temperature were made on all samples by means of X-ray diffraction photographs. Room temperature magnetic susceptibility and lattice parameter measurements strongly suggest that the samarium ions exist in an intermediate valence state for x is approximately > 0.06. Samples prepared in the concentration range, 0.03 = or < x = or < 0.06 show both mixed valence and intermediate valence phases. The magnetic susceptibility displays a valence transition with decreasing temperature in the region 60 to 160 K. Samples made with concentration, x, in the range 0.15 to 0.40 show a saturation of their magnetic susceptibilities below 10 K. The black phase present in samples with concentration, x is approximately < 0.05 is thought to be mixed valent. Room temperature lattice parameter measurements of these samples are consistent with a localized valence transition involving nearest neighbors. Dissert. Abstr.

N79-25893 New York Univ., N. Y.
A CALCULATION OF THE ELECTRICAL CONDUCTIVITY OF A ONE-DIMENSIONAL ELECTRON GAS WITH STRONG ATTRACTIVE ON-SITE INTERACTIONS Ph.D. Thesis
Stephen Thomas Janiszewski 1978 224 p
Avail: Univ. Microfilms Order No. 7912283

A technique, which provides correct results at temperatures and frequencies low enough so that only states near the Fermi-surface are important, was used to calculate the electrical conductivity of a one-dimensional electron gas. The system is assumed to be described by a generalized Hubbard model which includes inter-site, as well as on-site interactions. The lattice is taken to be fixed, and phonon effects are ignored. The actual results are obtained for a 1/2-filled band, in the strong coupling limit. Using this procedure, the zero temperature conductivity is obtained both in the presence and absence of impurity scattering. For the repulsive interaction, the conductivity vanishes trivially, and the system is a Mott insulator. For the attractive interaction, results are obtained for a range of negative values of the inter-site potential. The full zero temperature a.c. conductivity is also obtained for -1/2 sq t/U < V < 0 where t is the hopping amplitude, and U is the strength of the on-site interaction. Dissert. Abstr.

N79-25894 Illinois Univ. at Urbana-Champaign.
LOW TEMPERATURE, GLASS-LIKE PROPERTIES OF CRYSTALLINE BETA-ALUMINA Ph.D. Thesis
Philip John Anthony 1978 167 p
Avail: Univ. Microfilms Order No. 7913375

The low temperature properties measured for single crystal Na, Ag, K, and Li-beta-alumina are characteristic of those found in amorphous materials. The specific heat is dominated below 1 K by a term approximately linear in temperature instead of the cubic dependence normal for crystals. The dielectric susceptibilities of the beta-aluminas vary a few parts in 100 over three orders of magnitude in temperature, with the dependences again of the same form as those found in glasses. Unlike glasses, however, the variations of susceptibility for all but Li-beta-alumina are found to be extremely anisotropic. The magnitudes of the measured properties are dependent on the species of metal ion present. The glass-like properties measured indicate that there is present in the beta-aluminas a broad band of low energy excitations associated with the cations in the planes. Dissert. Abstr.

N79-25895 Illinois Univ. at Urbana-Champaign.
CHARGE TRANSFER STATES IN ALKALI METALS Ph.D. Thesis
Recep Avci 1978 231 p
Avail: Univ. Microfilms Order No. 7913377

The excitation spectra of halogen impurities in alkali metals was investigated throughout the photon energy range from 5 eV to 12 eV. The charge transfer configurations adopted by a variety of impurities in alkali metals were further investigated by measurements of the composition and temperature dependence of the electrical resistivity. Charge transfer effects observed to cause metal-to-insulator transitions at specific critical concentrations of Xe, I, Te, Sb, and Sn impurities in the Cs host lattice are identified and discussed. The trend of residual resistivity with impurity valence, for elements of the silver row of the Periodic Table, exhibits a sharp discontinuity between Sn and Sb. This discontinuity is interpreted as due to the formation of the charge transfer configuration for Sb, Te, and I impurities. Dissert. Abstr.

N79-25896 Auburn Univ., Ala.
A COMPUTER MODEL FOR CURRENT FILAMENTATION

IN SECOND BREAKDOWN OF SILICON-ON-SAPPHIRE DIODES Ph.D. Thesis
Aradhana Baruah 1979 214 p
Avail: Univ. Microfilms Order No. 7913685

An electrothermal model of current filamentation in a reverse biased thin film silicon-on-sapphire diode is presented which includes the effects of device doping, heat transfer in the plane of the diode and into the sapphire substrate, external circuital constraints, and geometric irregularities at the pn junction. Each device has a n region of width 204 micron, length 30 micron, and doping 10 to the 22d power atoms/cu micron. The model can follow the growth of filaments to temperatures of about 1400 K, then, as the filament rapidly approaches the melting point of silicon (1683 K) the solution becomes unstable. Results are related to experimental data on diodes having straight and spiked junctions. Dissert. Abstr.

N79-25897 New York Univ., N. Y.
ELECTRON PARAMAGNETIC RESONANCE STUDY OF TRIPLET EXCITON DYNAMICS IN ORGANIC MOLECULAR CRYSTALS Ph.D. Thesis
William Edward Bizzaro 1978 215 p
Avail: Univ. Microfilms Order No. 7912258

Optically excited triplet excitons in crystalline anthracene, pyrene, and tetracene were studied at room temperature and at a frequency of 24 GHz. A theoretical and experimental re-examination of the electron paramagnetic resonance spectrum employs the solution of a set of rate equations using spin relaxation rates deduced from the linewidth spectrum. The populating rates are derived from Suna's theory of diffusion mediated exciton-exciton annihilation as applied to the prompt fluorescence from tetracene. Calculated spectra are in favorable agreement with experiment results. Dissert. Abstr.

N79-25898 California Univ., Irvine.
SURFACE RESPONSE OF EXCHANGE AND DIPOLAR COUPLED FERROMAGNETS: APPLICATIONS TO LIGHT SCATTERING AND MAGNETOELASTIC WAVES Ph.D. Thesis
Robert Edwin Camley 1979 251 p
Avail: Univ. Microfilms Order No. 7913952

The spectral density of surface spin fluctuations was used to analyze the influence of exchange coupling and surface spin pinning on the frequency, linewidth, and lineshape of the Damon-Eshbach surface spin wave. The theory of Brillouin scattering from spin waves near magnetic surfaces is developed and the spectrum of scattered light for experimentally interesting geometries is calculated. The propagation of surface magnetoelastic waves on a ferromagnetic crystal which includes the effect of the exchange energy and the pinning of surface spins is investigated for a semi-infinite ferromagnet, and a ferromagnetic film bonded to a nonmagnetic substrate. Magnetoelastic waves which correspond to both Rayleigh waves and Love waves were found to be modified by the magnetoelastic interaction. Deviations from the elastic wave characteristics were found in the frequency region where bulk and surface spin waves propagate.
Dissert. Abstr.

N79-25899 Stanford Univ., Calif.
PHOTOEMISSION STUDIES OF THE OXIDATION OF AND SCHOTTKY BARRIER FORMATION ON Ga-Sb, InP AND GaAs Ph.D. Thesis
Patrick Wai-Kong Chye 1979 173 p
Avail: Univ. Microfilms Order No. 7912353

Studies of surface and interface states of clean, oxidized, and metal (cesium or gold) covered surfaces of cleaved indium phosphides and gallium antimonide are described. Formation of the gold Schottky barrier on gallium arsenides is also described. The technique used in the studies was photoemission spectroscopy. Early work using low energy photons from a hydrogen discharge lamp is described. Further experiments were carried out and are described. Experiments on the formation of the gold Schottky barrier showed that there was strong gold-semiconductor interaction. Synchronous and helium-1 radiation were used to examine the chemical shifts and valence band structural changes on the gallium antimonide and indium phosphide surfaces upon exposure to oxygen. Dissert. Abstr.

N79-25900 California Univ., Davis.
OPTICAL AND ELECTRONIC PROPERTIES OF SOME TERNARY SEMICONDUCTORS AND DYNAMICAL PROPERTIES OF CRYSTALLINE POLYMORPHS AND AMORPHOUS SOLIDS OF GROUP IV ELEMENTS Ph.D. Thesis
Maged Mansour El-Batanouny 1978 149 p
Avail: Univ. Microfilms Order No. 7912958

The study comprises two parts. The first part included experimental and theoretical investigations of the optical and electronic properties of group V-VI-VII ternary semiconductor crystals. The experimental endeavor involved measurement of the optical reflectance spectra of some crystals with antimony as the group V component. The measurements were confined to photon energy ranges of about 4 eV around the energy gap. The measured spectra were subsequently used in fitting the corresponding electronic band structures. A simpler model for the electronic structure of these materials was constructed. In the second part, the effect of local distortions in the bonding configuration of group IV elements on their vibrational properties was investigated. The study was confined to the BC-8 polymorph structure which essentially incorporates geometric-type distortions. Dissert. Abstr.

N79-25901 Illinois Univ. at Urbana-Champaign.
STUDIES OF THE LOW TEMPERATURE ANOMALY IN PALLADIUM HYDRIDE Ph.D. Thesis
Thomas Edward Ellis 1978 133 p
Avail: Univ. Microfilms Order No. 7913443

The electrical resistance anomaly was studied to determine the effects of varying hydrogen concentration. The temperature of the resistive peak was seen to increase with H(D)/Pd for ratios above .63. Samples of Pd-H and Pd-D with high (T sub a > 70 K) anomaly temperatures were held below T sub a for extended time periods. Resistance was seen to fall by up to 60% after several days of annealing. Reductions in annealing temperature caused further reductions in resistance. The changes are reversible; heating the samples to 90 K or more restored the original resistance. A neutron diffraction experiment on a single crystal of PdD sub 76. Annealing the crystal at 70 K produced super-lattice diffraction lines belonging to the star (4/52/50). The growth of the new lines with time bears a striking relationship to the resistance behavior. The peaks were erased by heating to 90 K, and reappeared at the same locations when the crystal was again annealed at 70 K. Dissert. Abstr.

N79-25902 New York Univ., N. Y.
MAGNETO-THERMAL PROPERTIES OF CUBIC RARE-EARTH COMPOUNDS Ph.D. Thesis
Louis Frank Uffer 1978 188 p
Avail: Univ. Microfilms Order No. 7912332

A model Hamiltonian for cubic rare-earth compounds called the pnictides was studied. These are systems described by Hamiltonians which include bilinear and higher degree pair interactions. They are characterized by two observable order parameters and can undergo both a magnetic and structural phase transition. The phase space associated with the model is mapped for regions which illustrate the effects of competing interactions. The phase space is found to contain multicritical points. The neighborhood of a tricritical point (TCP) is explored and the effects of ordering and non-ordering fields are studied. At a point where the lowest six levels of the crystal field become degenerate it is found that the model has tricritical-like exponents with a bilinear interaction only. At this point (the level crossing point) the bilinear interaction maps onto a spin-one model at a TCP. The biquadratic interaction is mapped onto a spin 1/2 model described by Griffiths near the model's critical end point.
Dissert. Abstr.

N79-25903 California Univ., Los Angeles.
EXPERIMENTAL STUDIES OF INDUCED SUPERCONDUCTIVITY IN NORMAL METALS BY PROXIMITY EFFECT TUNNELING Ph.D. Thesis
Boris Francois ODonovan-Vojtovic 1979 184 p
Avail: Univ. Microfilms Order No. 7913746

The density of states of a normal metal in good contact with a superconductor (N-S junction) is due to two separate contributions. The Andreev scattering at the N-S interface produces interference in N and thus an oscillatory function in the density

of states. The induced pair potential in N shows structure at energies associated with the phonon modes of N. Electron tunneling is explained and it is shown that the conductances (dI/dV) of a tunnel junction is proportional to the density of states of both electrodes. A diagram is shown representing the circuit used to measure I vs V, first and second derivatives of a tunnel junction. Diffusion for the Sn-Pb system and the Fermi velocity in N are discussed. Trilayer junctions of the form Al-Ox-Ag-Cu-Pb or Al-Ox-Cu-Ag-Pb show normal phonon structures of only the metal adjacent to the oxide in addition to the interference of the electron wave-function produced in both normal metals. Both N-Ox-S and N-Ox-N-S junctions in the gapless regime are examined by the application of a magnetic field higher than the bulk critical field. Dissert. Abstr.

N79-25904 Illinois Univ., Urbana-Champaign.
DIFFUSION OF TITANIUM AND NIOBIUM IN B.C.C. Ti-Nb ALLOYS Ph.D. Thesis
Arthur Erwin Pontau 1978 84 p
Avail: Univ. Microfilms Order No. 7913578

The diffusion coefficients for titanium and niobium radioactive tracers were simultaneously measured in Ti, Ti sub 94.6 Nb sub 5.4, Ti sub 80.4 Nb sub 19.6, and Ti sub 64.3 Nb sub 35.7 over the temperature range from 950 C to 1511 C using standard lathe sectioning techniques. The samples were initially heat treated by annealing above the alpha-Beta phase transition temperature and then either cooling slowly to room temperature or quenching. The room temperature crystal morphology was then examined using X-ray diffraction. Alloy concentrations were chosen both to suppress the Beta-alpha transition and to obtain the metastable omega-phase. Dissert. Abstr.

N79-25905 City Univ. of New York.
LIGHT SCATTERING INVESTIGATION OF THE CENTRAL PEAK AT THE FERROELECTRIC TRANSITION IN KH2PO4 Ph.D. Thesis
Marc David Mermelstein 1979 158 p
Avail: Univ. Microfilms Order No. 7913150

A dynamic central peak of width approximately 50 MHz was observed in the depolarized-light-scattering spectrum of KH2PO4. It is seen only in the ferroelectric phase within 0.1 K of the transition, where its intensity exceeds that of the strongest Brillouin component, the xy shear mode. It is shown that this strongly temperature-dependent feature arises from the coupling of the ferroelectric soft mode to the thermal diffusion mode in the ferroelectric (but not in the paraelectric) phase through the temperature dependence of the order parameter, the spontaneous polarization. Thermodynamic predictions for the temperature dependence of linewidth and the temperature and electric field dependence of the intensity are in agreement with the experimental results. Dissert. Abstr.

N79-25906 Oklahoma State Univ., Stillwater.
OPTICAL SPECTROSCOPIC STUDIES OF KCl:Eu-2+ AND Nd-3+ DOPED GARNET CRYSTALS Ph.D. Thesis
Larry Dean Merkle 1978 237 p
Avail: Univ. Microfilms Order No. 7912642

Optical investigations of several nonradiative processes are reported. Studies of energy transfer, radiationless relaxation, vibronic emission and thermal linewidth and lineshift of Eu(2+) in KCl are reported, as are investigations of energy transfer among Nd(3+) ions in YAG and YGaG crystals. Techniques used include time resolved spectroscopy and laser site selection for energy transfer studies and photoacoustic spectroscopy for the study of radiationless relaxation. Dissert. Abstr.

N79-25907 Adelphi Univ., Garden City, N. Y.
A CRYSTALLOGRAPHIC INVESTIGATION OF PENTAERYTHRITOL AND SEVERAL RELATED COMPOUNDS Ph.D. Thesis
Donna Langer Eilerman 1979 234 p
Avail: Univ. Microfilms Order No. 7913335

The three dimensional crystal structures of a series of molecules were determined using single crystal X-ray diffraction techniques. All of the studied compounds are known to transform to an orientationally disordered plastic phase at temperatures below their melting points. The structure of pentaerythritol, the parent compound of this series, was refined from partially known atomic positions. The room-temperature crystal structure of 2-amino-2-hydroxymethyl-1,3-propanediol was determined, and in addition structural studies were done at -129 C and 75 C. Single crystals of this material have been grown in the plastic phase and body-centered cubic cell was determined. The room-temperature crystal structure of tris (hydroxymethyl) acetic acid and of 2-hydroxymethyl-2-methyl-1,3-propanediol were elucidated. The structural similarities among these compounds are discussed, and the hydrogen bonding schemes are compared. Dissert. Abstr.

N79-25908 Stanford Univ., Calif.
CRYSTAL STRUCTURE DETERMINATION USING SYNCHROTRON RADIATION Ph.D. Thesis
James Christopher Phillips 1979 123 p
Avail: Univ. Microfilms Order No. 7912400

An account of a project to explore the possibility of using synchrotron radiation as an X-ray source for crystallographic structure determination in cases where conventional sources prove inadequate is given. The experiments were performed using the storage ring SPEAR. An historical perspective of the experiments is given and early results are discussed. Based on experience gained, design criteria for a beam line for diffraction experiments were established. A suitable beam line was constructed and the design and construction of a four-circle goniometer system which utilizes this beam line is described. Measurement of anomalous scattering terms for cesium and cobalt as a function of wavelength was performed. Large effects to phase diffraction patterns from macromolecules are discussed. Phase information for the diffraction pattern of a cesium-gramicidin A crystalline complex was obtained. Dissert. Abstr.

N79-25909*# Naval Academy, Annapolis, Md.
OSCILLATOR STRENGTH TRENDS IN GROUP IVb HOMOLOGOUS IONS
Myron H. Miller and Roger D. Bengtson [1978] 16 p refs
Prepared in cooperation with Maryland Univ., College Park and Texas Univ. at Austin
(Grant NGR-44-012-258)
(NASA-CR-158688) Avail: NTIS HC A02/MF A01 CSCL 20L

Shock tube data are used to examine the systematic f value behavior in prominent visible transition arrays (ns-np, np-(n+l)s, np-nd) for the homologous emitter sequence Si 11, Ge 11, Sn 11, and Pb 11. Regularities found for these data are compared with trends in lighter elements. Agreements and s disparities with theoretical and experimental oscillator strengths from the literature are noted. Author

N79-25910# Cornell Univ., Ithaca, N. Y.
CONTROLLED GRAIN BOUNDARY STRUCTURES IN SUPERCONDUCTORS Annual Technical Report, 1 Jan. - 31 Dec. 1978
Edward J. Kramer Feb. 1979 23 p refs
(Grant AF-AFOSR-3107-77)
(AD-A067310; AFOSR-79-0373TR) Avail: NTIS HC A02/MF A01 CSCL 20/3

The relationship between grain boundary structure and chemistry and the critical current properties of superconductors is being investigated. The critical current (flux pinning) contributed by single grain boundaries in Nb bicrystals has been observed and shown to be suprisingly large even for boundaries that should have no crystal anisotropy or stress field contribution to the elementary interaction force between a grain boundary and the flux line lattice. Transmission electron microscopy and X-ray topography have been used to characterize the grain boundary structure, and bicrystal substructure respectively. The first high angle symmetric tilt examined is straight, shows no periodic structure and appears to be free of precipitates or detectable segregation. The electron float zone welding method of bicrystal manufacture is shown to give rise to very low angle subboundaries lying approximately parallel to the main grain boundaries. These contribute an annoyingly high background critical current which makes isolation of the main boundary contribution somewhat uncertain. GRA

N79-25911# Stanford Univ., Calif. Center for Materials Research.

A FEASIBILITY STUDY ON THE GROWTH OF BULK GaN SINGLE CRYSTALS Final Report
W. A. Tiller Feb. 1979 18 p refs
(Contract N00019-78-C-0105)
(AD-A066637; SU-CMR-79-2) Avail: NTIS HC A02/MF A01 CSCL 20/2

The III-V semiconducting phosphides, arsenides and antimonides have been extensively investigated in recent years both with regard to single crystal growth and property evaluation. Relatively high quality material in the form of large single crystals and epitaxial layers can be routinely produced, and many of these materials have found use in device applications. The group III nitrides, on the other hand, have received little attention by comparison and techniques have not been sufficiently developed for the production of either adequate quality bulk single crystals or epitaxial layers. Of the group III nitrides, GaN is of particular interest because it has a wide, direct bandgap (3.4 eV at 300 K) and is potentially useful as an electroluminescent material and injection laser. The possibility of extending the laser frequency with this material further into the visible (into the blue-green region) is very attractive for a number of underwater applications. Author (GRA)

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

N79-25912 Florida Univ., Gainesville.
THERMODYNAMIC PROPERTIES OF HIGH-PRESSURE LIQUID MIXTURES CONTAINING SUPERCRITICAL COMPONENTS Ph.D. Thesis
Paul M. Mathias 1978 194 p
Avail: Univ. Microfilms Order No. 7913303

A method was developed for describing liquid-phase fugacities in order to predict high-pressure vapor-liquid equilibrium of systems containing supercritical components. A solution theory is formulated to provide expressions for the change in fugacity of components of a multicomponent fluid due to any change in the state of the system in terms of integrals of the statistical mechanical direct correlation function. The method not only provides an excellent description of the nonideality of gas-solvent liquid mixtures including even those with highly polar solvents but also yields good predictions of vapor-liquid equilibrium at elevated pressures and relates Henry's constants of a solute in two different solvents. A method is proposed to calculate phase equilibrium by treating the solvent mixture as a pseudo-component. This is very useful for gas solubility in uncharacterized, complex solvent mixtures. Investigations of the n-butane-n-decane-methane ternary indicate that this is likely to be a viable approach. Dissert. Abstr.

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N79-25913*# Computer Sciences Corp., El Segundo, Calif.
WORK MANAGEMENT PLAN FOR DATA SYSTEMS AND ANALYSIS DIRECTORATE
Lee R. Nichols 1 May 1979 27 p
(Contract NAS9-15700)
(NASA-CR-160191; Rept-79-FD-011; JSC-14885) Avail: NTIS HC A03/MF A01 CSCL 05A

A contract with the Data Systems and Analysis Directorate contains a specified level of resources related to a specific set of work in support of three divisions within the Data Systems and Analysis Directorate. The divisions are Institutional Data Systems Division, Ground Data Systems Division, and Mission Planning and Analysis Division. The Statement of work defines at a functional requirements level the type of support to be provided to the three divisions. The contract provides for further technical direction to the contractor through issuance of Job Orders. The Job order is the prime method of further defining the work to be done, allocating a portion of the total resources in the contract to the defined tasks, and further delegating technical responsibility. G.Y.

N79-25914*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PLANNING AND MANAGING FUTURE SPACE FACILITY PROJECTS
Joan E. Sieber (California State Coll., Hayward), John A. Wilhelm (Texas Univ., Austin), Trieve A. Tanner, Robert L. Helmreich (Texas Univ., Austin), and Susan F. Burgenbauch (Texas Univ., Austin) May 1979 29 p refs
(NASA-TM-78586; A-7811) Avail: NTIS HC A03/MF A01 CSCL 05A

To learn how ground-based personnel of a space project plan and organize their work and how such planning and organizing relate to work outcomes, longitudinal study of the management and execution of the Space Lab Mission Development Test 3 (SMD 3) was performed at NASA Ames Research Center. A view of the problems likely to arise in organizations and some methods of coping with these problems are presented as well as the conclusions and recommendations that pertain strictly to SMD 3 management. Emphasis is placed on the broader context of future space facility projects and additional problems that may be anticipated. A model of management that may be used to facilitate problem solving and communication - management by objectives (MBO) is presented. Some problems of communication and emotion management that MBO does not address directly are considered. Models for promoting mature, constructive and satisfying emotional relationships among group members are discussed. A.R.H.

N79-25915*# Computer Sciences Corp., Houston, Tex. Applied Technology Div.
DESIGN SPECIFICATION, INTEGRATED PROCUREMENT MANAGEMENT SYSTEM, VERSION 2 (IPMS-2) ONLINE SUBSYSTEM, VOLUME 1
L. E. Ely Apr. 1979 184 p
(Contract NAS9-15700)
(NASA-CR-160248; JSC-14847) Avail: NTIS HC A09/MF A01 CSCL 05A

The design for the online subsystem is detailed. Input template design and processing logic for all pr, contract, and CCA forms used by the Procurement Operations Office are discussed. A.R.H.

N79-25916# Dayton Univ., Ohio. Research Inst.
FORCE MANAGEMENT METHODS. TASK 1 REPORT. CURRENT METHODS Interim Report, 26 Sep. 1977 - 25 Sep. 1978
Larry E. Clay, Ned. H. Sandlin, Douglas S. Morcock, K. E. Brown, and R. L. Johnson Dec. 1978 500 p refs
(Contract F33615-77-C-3122)
(AD-A066593; UDR-TR-78-85; AFFDL-TR-78-183) Avail: NTIS HC A21/MF A01 CSCL 01/3

A state-of-the-art survey was conducted as the initial phase of the preparation of a handbook of methods for accomplishing force management in accordance with the requirements of MIL-STD-1530A. This report presents the results of the survey and summarizes the information gathered from visits to 47 organizations and from a review of pertinent literature. In

particular, the current methods for accomplishing individual aircraft tracking loads/environment spectra surveys, and force structural maintenance planning are described. Those methods which satisfy MIL-STD-1530A requirements are recommended for inclusion in the handbook. Data collection and data processing methods are reviewed and compared in terms of accuracy and cost. The coordination of the major elements of force management is reviewed with emphasis on the organizational and data analysis interfaces. Specific force management data was collected on all major operational Air Force airplanes and a summary for each is also presented. Author (GRA)

N79-25917# Stanford Univ., Calif. Dept. of Computer Science.

A FRAMEWORK FOR CONTROL IN PRODUCTION SYSTEMS

Michael Georgeff Jan. 1979 38 p refs
(Contract MDA903-76-C-0266; ARPA Order 2494)
(AD-A066561; SU-STAN-CS-79-716; AIM-322) Avail: NTIS HC A04/MF A01 CSCL 09/2

A formal model for representing control in production systems is defined. The formalism allows control to be directly specified independently of the conflict resolution scheme, and thus allows the issues of control and nondeterminism to be treated separately. Unlike previous approaches, it allows control to be examined within a uniform and consistent framework. It is shown that the formalism provides a basis for implementing control constructs which, unlike existing schemes, retain all the properties desired of a knowledge based system -- modularity, flexibility, extensibility and explanatory capacity. Most importantly, it is shown that these properties are not a function of the lack of control constraints, but of the type of information allowed to establish these constraints. Within the formalism it is also possible to provide a meaningful notion of the power of control constructs. This enables the types of control required in production systems to be examined and the capacity of various schemes to meet these requirements to be determined. Schemes for improving system efficiency and resolving nondeterminism are examined, and devices for representing such meta-level knowledge are described. In particular, the objectification of control information is shown to provide a better paradigm for problem solving and for talking about problem solving. It is also shown that the notion of control provides a basis for a theory of transformation of production systems, and that this provides a uniform and consistent approach to problems involving subgoal protection. Author (GRA)

N79-25918# Army Research Inst. for the Behavioral and Social Sciences, Alexandria, Va.

PERCEIVED WORK EFFORT AS TIME DEVOTED TO AN ACTIVITY

John R. Turney and Stanley L. Cohen Sep. 1978 22 p refs (DA Proj. 2Q1-62717-A-779; DA Proj. 2Q7-62722-A-765)
(AD-A062411; ARI-TP-337) Avail: NTIS HC A02/MF A01 CSCL 05/9

Work effort is one of the quantitative measures in organizational effectiveness programs, but little has been done to measure effort itself or its external indicators. This research explores the extent to which self-estimates of effort expended on specific activities are related to actual time spent. Self-estimates of the effort and amount of time spent on specific activities were collected from 31 soldiers in an information-processing facility. At the same time, a computer recorded the amount of time actually spent on each activity. Analysis of the data indicated that the perceptual measures of effort correlated significantly with actual durations across different activities and different measures of time. On the average, 25% of the variance in effort was accounted for by time. External indicators of work effort can measure either intensity or duration of expended effort. When external indicators of intensity are also developed, it should be possible to determine how adequately self-estimates of effort can be anchored in external reality by incorporating measures of both intensity and duration across a range of Army jobs and organizational settings. Author (GRA)

N79-25919# California Univ., Berkeley. Inst. of Transportation Studies.

TRANSPORTATION SYSTEM MANAGEMENT ACTIONS: IMPLICATIONS OF FLEXIBLE WORK HOURS Final Report, Sep. 1975 - Dec. 1977

David W. Jones, Takuya Nakamoto, and Matthys P. Cilliers Dec. 1978 66 p refs
(Contract DOT-OS-50237)
(PB-292448/8; UCB-ITS-RR-78-4; DOT/RSPA/DPB-50/78/29) Avail: NTIS HC A04/MF A01 CSCL 13B

Strategies to reduce peaking in urban transportation through work rescheduling are an element of Transportation System Management. Most discussions of work schedule management focused on work staggering and the four-day week. The merit of flexible or variable work hours as a traffic management strategy is considered. It concludes that flextime is compatible with programs that seek to increase bus ridership and carpooling. Flextime appears promising as a strategy of congestion relief. A survey of almost 500 employees of a California State agency which recently adopted flexible work hours was made. An analysis of the peaking characteristics of travel to and from the San Francisco Central Business District are presented. GRA

N79-25920# California Univ., Berkeley. Inst. of Transportation Studies.

TRANSPORTATION SYSTEM MANAGEMENT: PROMISE, PERFORMANCE AND PROGNOSIS Final Summary Report, Sep. 1975 - Sep. 1977

David W. Jones, William L. Garrison, and Adolf D. May Dec. 1978 43 p refs
(Contract DOT-OS-50237)
(PB-292447/0; DOT/RSPA/DPB-50/78/30) Avail: NTIS HC A03/MF A01 CSCL 13B

An assessment of the efficiency of transportation system management (TSM) as both a strategy of transportation system improvement and a philosophy of planning administration was presented. The impetus for TSM and its roots in the recent history of transportation planning and finance was discussed. Conclusions about the efficacy of TSM planning were discussed and a model TSM planning process that responds to the conclusions reached was proposed. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N79-25921 Minnesota Univ., Minneapolis.

ACCELERATED SEARCHING STRATEGIES IN LARGE, HIGHLY STRUCTURED DATA BASES Ph.D. Thesis

Thomas P. Sturm 1978 257 p
Avail: Univ. Microfilms Order No. 7912087

The problems involved in storing, organizing, and searching large data bases are examined. Of particular concern are data bases in which complex structural interrelationships between data items must be preserved. A systems point of view to accelerate associative searches which have low hit ratios in these large, highly structured data bases is taken. Three aspects of the data base management problem are examined: the storage hardware, the data base organization, and the searching strategies. Hardware technology is examined and it is concluded that large data bases can make effective use of back-end hardware features currently under development. The data base organization is examined and it is concluded that clustering is the most effective way to store the data. The concept of a pattern bit map is developed to take advantage of back-end hardware and clustered data organization. Dissert. Abstr.

N79-25922 Commission of the European Communities, Luxembourg.

EURONET: A NEW COMPREHENSIVE INFORMATION UTILITY FOR THE EUROPEAN USER

H. Ungerer 1978 12 p refs
Avail: Issuing Activity

The European online information network EURONET is an

EEC project which aims at merging current and future publicly available online information services in the member states into a common network on a cooperative basis. The status of the project to date is reviewed, details on the intended services are provided, and some aspects of its impact on the European information environment are analyzed. Author (ESA)

N79-25923*# General Electric Co., Houston, Tex. Space Div.
AUTOMATED SYSTEM FOR INTEGRATION AND DISPLAY OF PHYSIOLOGICAL RESPONSE DATA Final Report
30 Jun. 1975 59 p refs
(Contract NAS9-12932)
(NASA-CR-141933; TIR-741-MED-5013) Avail: NTIS HC A04/MF A01 CSCL 05B

The system analysis approach was applied in a study of physiological systems in both 1-g and weightlessness, for short and long term experiments. A whole body, algorithm developed as the first step in the construction of a total body simulation system is described and an advanced biomedical computer system concept including interactive display/command consoles is discussed. The documentation of the design specifications, design and development studies, and user's instructions (which include program listings) for these delivered end-terms; the reports on the results of many research and feasibility studies; and many subcontract reports are cited in the bibliography. A.R.H.

N79-25924# System Development Corp., Santa Monica, Calif.
RESEARCH ON DEDUCTIVE INFERENCE FOR LARGE DATA BASES Final Technical Report, 1 Apr. 1976 - 30 Dec. 1978
Charles Kellogg and Iris Kameny 31 Jan. 1979 135 p refs
(Contract N00014-76-C-0885; ARPA Order 3162)
(AD-A066364; SDC-TM-6263/0) Avail: NTIS HC A07/MF A01 CSCL 09/2

The research has as its major goal the construction of software tools to aid on-line decision makers and data base users in accessing information relevant to their needs, in understanding the full data base search implications of their requests, and in reviewing and evaluating the utility of derived answers. The conceptual framework within which this research has been carried out is based upon mathematical logic. It is becoming increasingly clear that logic is, highly relevant not only to reasoning about data but to query language design, to data structuring, to the support of high level user views, to maintaining the integrity of data bases, and to making the transition from present day data-based systems to future knowledge-based systems. The main software tool that has been implemented as part of this research is called DADM (for Deductively Augmented Data Management). This report describes the design, implementation, and current capability of this prototype system. DADM adds a general knowledge base and a deductive processor to a data management system. These components are used to control the creation of intelligent data base access strategies and the construction of evidence to support derived answers. GRA

N79-25925# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
ROBUST CONCURRENCY CONTROL FOR A DISTRIBUTED INFORMATION SYSTEM Ph.D. Thesis
Warren A. Montgomery Dec. 1978 200 p refs
(Contract N00014-75-C-0661)
(AD-A066996; MIT/LCS/TR-207) Avail: NTIS HC A09/MF A01 CSCL 09/2

This dissertation presents a collection of protocols for coordinating transactions in a distributed information system. The system is modeled as a collection of processes that communicate only through message passing. Each process manages some portion of the data base, and several processes may cooperate in performing a single transaction. The thesis presents a model for computation in a distributed information system in which the sites and communication links may fail. The effects of such failures on the computation are described in the model. The thesis discusses implementation techniques that could be used to limit the effects of failures in a real system to those described in the model. A hierarchical protocol for coordinating transactions is presented. The accesses to be performed during a transaction are pre-analyzed to select the protocols needed to coordinate the processes that participate in the implementation of the transaction. This analysis can be used to guide the organization of the data base so as to minimize the amount of locking required in performing frequent or important transactions. An important aspect of this mechanism is that it allows transactions that cannot accurately be pre-analyzed to be performed and correctly synchronized without severely degrading the performance of the system in performing more predictable transactions. A novel approach to the problem of making updates at several different sites atomically is also discussed. This approach is based on the notion of a polyvalue, which is used to represent two or more possible values for a single data item. A polyvalue is created for an item involved in an update that has been delayed due to a failure. GRA

N79-25978# Shape Technical Center, The Hague (Netherlands).
EXPLOITING TECHNOLOGY FOR OPERATIONAL DECISIONS
I. R. Mirman *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 6 p refs (For primary document see N79-25977 16-99)
Avail: NTIS HC A16/MF A01

N79-25980# Cranfield Inst. of Technology Bedfordshire (England). School of Electronic System Design.
SOME TRENDS IN DATA ACQUISITION DISPLAY AND CONTROL
John T. Shepherd *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 27 p refs (For primary document see N79-25977 16-99)
Avail: NTIS HC A16/MF A01

N79-25989# Kongsberg Vapenfabrikk A/S (Norway).
BUDOS: A MULTIPLEX DATA BUS TRANSMISSION SYSTEM
S. Oderud *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 12 p (For primary document see N79-25977 16-99)
Avail: NTIS HC A16/MF A01

N79-25990# Admiralty Surface Weapons Establishment, Portsdown (England). Computer Div.
ADNET: AN EXPERIMENTAL INFORMATION DISTRIBUTION SYSTEM
T. D. Wells and M. G. Stainby *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 9 p (For primary document see N79-25977 16-99)
Avail: NTIS HC A16/MF A01

N79-26008# Naval Air Development Center, Warminster, Pa.
TACTICAL INFORMATION EXCHANGE SYSTEM
James R. Bonanno *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 10 p (For primary document see N79-25977 16-99)
Avail: NTIS HC A16/MF A01

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

No abstracts in this category.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N79-25926# Committee of Conference (U. S. Congress).
ENERGY TAX ACT OF 1978
[1978] 33 p H.R. 5263 enacted into law by the 95th Congr., 9 Nov. 1978

(Pub-Law-95-618; GPO-39-139) Avail: US Capitol, House Document Room

The text of an Act of Congress to provide tax incentives for the production and conservation of energy and for other purposes is presented. Topics covered under the three titles of the Act are residential energy credit; gas guzzler tax; motor fuels; provisions related to buses; incentives for van pooling; and changes in business investment credit to encourage conservation of, or conversion from, oil and gas to encourage new energy technology. Miscellaneous provisions relate to the treatment of untangible drilling costs for the purposes of minimum tax; depletion of geothermal deposits and natural gas from geopressurized brine; and rerefined lubricating oil. A.R.H.

N79-25927# Committee on Commerce, Science, and Transportation (U. S. Senate).

NASA AUTHORIZATION FOR FISCAL YEAR 1980, PART 2

Washington GPO 1979 507 p refs Hearings on S. 357 before the Comm. on Commerce, Sci., and Transportation, 96th Congr., 1st Sess., 21-22 and 28 Feb. 1979

(GPO-43-135) Avail: Comm. on Commerce, Sci., and Transportation

Testimony delivered and statements received to justify NASA's budget requests to support program management, research and development, construction of facilities, and other activities are presented. Implications of the civilian space policy, capabilities of the space shuttle, and the status of its main engine are discussed as well as accomplishments in advanced programs related to power systems, space platforms and space transportation systems, and satellite services. A.R.H.

N79-25928# Logistics Management Inst., Washington, D. C.

IMPLEMENTATION OF NATO GUIDELINES ON INTELLECTUAL PROPERTY RIGHTS

David M. Conrad, Dwight E. Collins, Michael K. Masterson, and Mark C. Morse Jan. 1979 110 p refs Revised

(Contract MDA903-77-C-0370)

(AD-A066805; LMI-RE803-Rev) Avail: NTIS HC A06/MF A01 CSCL 05/1

Increased standardization and interoperability of NATO weapons is now a major goal of DoD. The success of the cooperative programs necessary to achieve this goal will in large measure depend on the extent to which defense industries in the United States and other NATO countries can agree to share their Intellectual Property (IP). IP covers a broad range of technical knowledge and expertise, much of which companies consider to be private information that alone distinguishes them from their competitors. In early 1978, the Council of National Armaments Directors promulgated a set of guidelines for transfer of IP under NATO cooperative programs. LMI was asked to suggest actions that DoD could take to implement the guidelines and to make cooperative programs generally more attractive to industry. The guidelines require the United States and other NATO governments to be able to ensure transfer of IP among themselves and/or their designated contractors. In our view this requirement can best be satisfied not by the U.S. Government itself acquiring and transferring IP, but rather by international company-to-company transfers subject to Government oversight and review. This report recommends four actions that DoD, with the cooperation of other NATO countries, can take to facilitate IP transfers in NATO cooperative programs. GRA

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

N79-25929# Ecos, Inc., Boston, Mass.

COMMUNITY WATER MANAGEMENT, RESEARCH NEEDS FOR SMALL AND URBANIZING COMMUNITIES

David A. DelPorto May 1978 70 p refs

(Grant NSF 78-SP-0933)

(PB-291939/7; NSF/RA-780372) Avail: NTIS HC A04/MF A01 CSCL 13B

Various methods of approach in dealing with the water needs of small and urbanizing communities are outlined. Water quality issues, such as type of contamination and sources of pollution and historical perspectives of wastewater management, the re-definition and semantics of supply and demand, the conflict of environment vs. energy, and economic considerations are covered. GRA

N79-25930# Army Mobility Equipment Research and Development Command, Fort Belvoir, Va.

BASELINE TESTS OF THE SEBRING CITI-VAN ELECTRIC DELIVERY TRUCK

Edward J. Dowgiallo, Jr., Cornelius E. Bailey, Jr., Ivan R. Snellings, and William H. Blake Feb. 1979 41 p refs

(Contract EC-77-A-31-1042)

(AD-A066582; MERADCOM-2268; DOE/CONS-0421-4) Avail: NTIS HC A03/MF A01 CSCL 13/6

The Citi-Van Model 611N0003, an electric two-passenger multipurpose van, was tested at the US Army Aberdeen Proving Ground test facilities in Aberdeen, Maryland, as part of a Department of Energy (DOE) project to characterize the state-of-the-art of electric vehicles. The Citi-Van is manufactured in Sebring, Florida, by Sebring Vanguard, Inc. It is powered by eight 6-volt batteries that are connected to the motor through a contactor control actuated by a foot pedal to control motor speed. The 6-horsepower motor drives the rear wheels through a direct drive to the differential. No regenerative braking was provided. Author (GRA)

N79-25931# American Society of Landscape Architects Foundation, McLean, Va.

ACCESS TO THE ENVIRONMENT. VOLUME 1: INTRODUCTION, STUDY BACKGROUND, REVIEW OF LEGISLATION STANDARDS AND GUIDELINES, COST-BENEFITS OF BARRIER FREE DESIGN, PHYSICAL CHARACTERISTICS OF THE DISABLED AND THE HANDICAPPED AND THE DESIGN CONFIGURATIONS OF SITE ELEMENTS

Gary O. Robinette May 1978 110 p refs Sponsored in part by Architectural and Transportation Barriers Compliance Board, Wash., D. C. 3 Vol.

(Contract HUD-H-2002)

(PB-290801/0) Avail: NTIS HC A06/MF A01; also avail. in set of 3 reports HC E13 as PB-290800-SET CSCL 13M

A reference for landscape architects and designers of facilities that are barrier free to handicapped and disabled persons is presented. State and Federal legislation and standards on barrier-free facilities, cost-benefit estimates of facility construction and redesign, and design configurations for outdoor facilities that are accessible to the total population are reviewed. Information on designing site elements such as walks, seats, steps, drinking fountains, parking and open areas, ramps, stairs, lighting, and telephones to allow access to both the handicapped and the general population is given. Outdoor recreational facilities such as campsites, playgrounds, picnic areas, and swimming and fishing areas are also considered. GRA

N79-25932# American Society of Landscape Architects Foundation, McLean, Va.

ACCESS TO THE ENVIRONMENT. VOLUME 2: CASE STUDIES OF BARRIER FREE SITES

Gary O. Robinette Jun. 1978 104 p Sponsored in part by Architectural and Transportation Barriers Compliance Board, Wash., D. C. 3 Vol.

(Contract HUD-H-2002)

(PB-290802/8) Avail: NTIS HC A06/MF A01; also avail. in set of 3 reports HC E13 as PB-290800-SET CSCL 13M

Case studies of proposed or constructed site facilities throughout the U.S. which have been made barrier-free to handicapped or disabled persons are presented. Outdoor facilities are considered in these case studies of housing, campus, playground, transportation, and recreation areas. Elements of barrier-free construction or design include special doors that are wide enough for wheelchairs to pass through, special parking

areas close to buildings and equiped with ramps, elevators, rails, special drainage systems, buses with lifting equipment, paths and walkways that are clearly designated, stadium areas for wheelchairs, and playground equipment accessible to handicapped children. GRA

N79-25933# American Society of Landscape Architects Foundation, McLean, Va.
ACCESS TO THE ENVIRONMENT. VOLUME 3: APPENDICES, DOMESTIC AND INTERNATIONAL EXAMPLES OF LEGISLATION, GUIDELINES, STANDARDS AND CRITERIA, BIBLIOGRAPHY, LISTING OF PEOPLE AND ORGANIZATIONS CONTACTED, LOCATIONS OF BARRIER FREE SITES AND GLOSSARY OF TERMS
Gary O. Robinette Jul. 1976 651 p refs Sponsored in part by Architectural and Transportation Barriers Compliance Board, Wash., D. C. 3 Vol.
(Contract HUD-H-2002-R)
(PB-290803/6) Avail: NTIS HC A99/MF A01; also avail. in set of 3 reports HC E13 as PB-290800-SET CSCL 13M

Domestic and international examples of legislation, guidelines, standards and criteria for constructing and redesigning buildings to make them barrier free and therefore accessible to handicapped and disabled persons are presented. Specifications for doorways, walkways, sign levels, ramps, rails, elevators restrooms facilities, public telephones, lighting, floor surfaces, parking areas, buses and trains, and drinking fountains are presented. A list of people and organizations contacted in composing the volumes is provided, as well as a list of locations of barrier-free sites. GRA

N79-25934# Environmental Protection Agency, Washington, D. C. Facility Requirements Div.
MUNICIPAL WASTEWATER MANAGEMENT: PUBLIC ACTIVITIES GUIDE
Clem L. Rastatter, ed. (Conservation Foundation), John Hammond, and Larry McBennett Feb. 1979 126 p refs 2 Vol.
(PB-292393/6; EPA-430/9-79-005; FRD-7) Avail: NTIS HC A07/MF A01 CSCL 13B

A handbook is presented which was prepared for use in a training program to acquaint citizen leaders with the important decisions that are made in planning for the management of municipal wastewater. GRA

N79-25935# Environmental Protection Agency, Washington, D. C. Facility Requirements Div.
MUNICIPAL WASTEWATER MANAGEMENT: CITIZEN'S GUIDE TO FACILITY PLANNING
Clem L. Rastatter, ed. (Conservation Foundation), John Hammond, and Larry McBennett Jan. 1979 259 p refs 2 Vol.
(PB-292394/4; EPA-430/9-79-006) Avail: NTIS HC A12/MF A01 CSCL 13B

A handbook is presented which is organized around a logical progression of questions that the involved citizen or local governmental official is likely to encounter in trying to influence the municipal sewage facilities planning process. The Handbook reflects the latest federal regulations and policies, as of January 1979, and assumes a level of interest that is more than casual on the part of the reader. GRA

N79-25936# Transportation Systems Center, Cambridge, Mass.
TRANSIT SERVICE RELIABILITY Final Report, Feb. 1976 - Dec. 1978
Mark Abkowitz Dec. 1978 193 p refs Prepared in cooperation with Multisystems, Inc., Cambridge, Mass.
(Contract DOT-TSC-1083)
(PB-292152/6; DOT-TSC-UMTA-78-18; UMTA-MA-06-0049-78-1) Avail: NTIS HC A09/MF A01 CSCL 13B

A comprehensive overview is presented of the subject of transit service reliability and a framework for a program of demonstrations and research studies which could be carried out under the Service and Methods Demonstration program is provided. Major subject areas include the impact of service reliability from the operator's perspective, empirical measures of service reliability, causes of service reliability problems, techniques for improving service reliability, and recommendations for further research. Several findings are reported. GRA

N79-25937# Comsis Corp., Wheaton, Md.
QUICK-RESPONSE URBAN TRAVEL ESTIMATION TECHNIQUES AND TRANSFERABLE PARAMETERS. USER'S GUIDE Final Report
Arthur B. Sosslau, Amin B. Hassam, Maurice M. Carter, and George V. Wickstrom Washington Transportation Research Board Sep. 1978 237 p refs Sponsored by DoT and American Association of State Highway and Transportation Officials
(PB-292037/9; TRB/NCHRP/REP-187; ISBN-0-309-02775-6; LC-78-66460) Avail: NTIS HC A11/MF A01 CSCL 13B

Manual techniques are presented for use in each aspect of travel demand estimation; i.e., trip generation, trip distribution, model choice, auto occupancy, time-of-day distribution, traffic assignment, capacity analysis, and development density versus highway spacing relationships. Numerous charts, tables, and nomographs are included to simplify each analysis step. Data requirements are also reduced by making maximum use of transferable parameters developed from other studies and urban areas. Three scenario applications of the manual techniques are included to illustrate the potential of the various analysis techniques. GRA

N79-25938# Oklahoma State Univ., Stillwater. Dept. of Agricultural Engineering.
EVALUATION OF A PROTOTYPE AUTOMATED POND WATER TREATMENT UNIT Technical Completion Report, 1 Oct. 1976 - 30 Sep. 1978
Charles E. Rice, James E. Garton, and Molly L. Magnuson 1978 22 p refs
(PB-290750/9; W79-03764; OWRT-A-066-OKLA(1)) Avail: NTIS HC A02/MF A01 CSCL 13B

Two automatic pond water filtration units were tested with performance evaluated by analysis of both raw and treated water samples. A large filter, three feet in diameter, was tested and provided water at just over two gpm per square foot. The small filter, with an area of one square foot, was tested at various flow rates, run lengths, and total operating times. Both units were upflow filters with flocculation taking place below the filter media. The possibility of using the unit as a trailer-mounted assembly for emergency filtration unit for small town and rural water districts was discussed. GRA

N79-25939# Oklahoma State Univ., Stillwater. School of Mechanical and Aerospace Engineering.
A HYDRAULIC MODEL STUDY OF PROPELLER-TYPE LAKE DESTRATIFICATION PUMPS Technical Report, Oct. 1977 - Sep. 1978
D. K. McLaughlin and M. R. Givens 1978 74 p refs
(Contract DI-14-34-0001-8038)
(PB-290901/8; W79-04079; OWRT-A-075-OKLA(1)) Avail: NTIS HC A04/MF A01 CSCL 13B

A hydraulic model study was performed of the local destratification phenomenon using a Garton type propeller prototype and model experiments. Geometrically similar models of a Garton pump were constructed in varying sizes. Experiments were conducted to model the near flowfield of the propeller in the vicinity of a typical dam and release structure. The local destratification experiments involved pumping a jet of surface water down into the heavier bottom water. GRA

N79-25940# Environmental Protection Agency, Washington, D. C. Municipal Construction Div.
USA/USSR 6TH SYMPOSIUM ON ADVANCED EQUIPMENT AND FACILITIES FOR WASTEWATER TREATMENT
May 1978 81 p refs Symp. held at Cincinnati, 9-10 May 1978; sponsored by USA-USSR Working Group on the Prevention of Water Pollution from Municipal and Industrial Sources
(PB-290996/8) Avail: NTIS HC A05/MF A01 CSCL 13B

The eleven papers that were presented at the symposium described advanced techniques and equipment for the treatment of municipal and industrial waste water. GRA

N79-25941# Georgia Univ., Athens. Dept. of Real Estate and Urban Development.
THE DEVELOPMENT OF A TRANSPORTATION PLANNING LAND USE MODEL Final Report
Charles F. Floyd (Georgia Dept. of Transportation, Atlanta), Michael J. Rowan, James B. Kau, and Hal S. Maggied Mar. 1978

132 p refs Sponsored by Federal Highway Administration and Georgia Dept. of Transportation
(PB-292332/4) Avail: NTIS HC A07/MF A01 CSCL 13B

The Georgia transportation planning land use model designed to aid transportation planners in ascertaining the impact of a rural transportation corridor improvement on the economic and land use structure of adjoining communities, is described and preliminary test results and final testing for five project corridors in Georgia are presented. Projections of employment population, and housing are allocated to counties based upon multiple regression analysis, shift-share analysis, and other techniques. These projectors were compared with the Delphi Forecast and then translated into projected future land consumption by the land supply submodel. The available usable land supply in the test area appears to be fully adequate to accommodate projected economic growth and development beyond 1990. GRA

N79-25942# TRW Environmental Services, Vienna, Va.
SOURCE EMISSION TESTS AT THE BALTIMORE DEMONSTRATION PYROLYSIS FACILITY Final Report
John L. Haslbeck and Billy C. McCoy Dec. 1978 87 p refs
(Contract EPA-68-01-2988)
(PB-292113/8; EPA-600/7-78-232) Avail: NTIS HC A05/MF A01 CSCL 13B

When plant construction was completed in January, 1975, it was determined that the pollutant control equipment did not meet particulate emission standards. This necessitated a comprehensive test program designed to quantify the extent of the pollution and evaluate the environmental impact of this plant. The test program was designed to measure the following flue gas parameters; particulate; SO2/SO3; NO(x); HCl; HF; total hydrocarbons; hydrocarbon compounds exceeding 1% of the total hydrocarbon value; but not more than 20; and trace metals. Atmospheric diffusion models were employed to assess the environmental impact of both the existing plant configuration and the proposed pollution control system. The proposed system consists of an electro-static precipitator exhausting to a 220 ft stack. GRA

N79-25943# Delta Research Corp., Arlington, Va.
AN INTERNATIONAL STUDY OF ECONOMIC BENEFITS ATTRIBUTABLE TO R AND D, BY SOURCE AND SECTOR OF PERFORMANCE Final Report
Robert U. Ayres, Jordan Lewis, and Stephen D. Collier Jun. 1978 71 p refs
(Contract NBS-8-04299)
(PB-292783/8; NBS-GCR-ETIP-78/60) Avail: NTIS HC A04/MF A01 CSCL 05C

Evidence found in a study performed on the nature of the interrelationships between public and private research and development and economic performance is reported. The historical records of various countries are compared. GRA

N79-25944# Stanford Univ., Calif. Dept. of Civil Engineering.
ENVIRONMENTAL CONSIDERATIONS IN HIGHWAY PLANNING BY THE CALIFORNIA DEPARTMENT OF TRANSPORTATION
John J. Meersman, Leonard Ortolano, and Rae M. Shikuma Dec. 1978 255 p refs
(Grant NSF PRA-75-22340)
(PB-292548/5; SU-IPM-9; NSF/PRA-7522340/4) Avail: NTIS HC A12/MF A01 CSCL 13B

The District's organizational design, attitudes of planners and engineers, procedures regarding external coordination, and the timing of environmental activities relative to key decision making points in a planning study were examined. The District Four research was undertaken primarily as an exploratory study to determine if factors that affect the influence of environmental considerations in water resources planning also affect the influence of environmental considerations in highway planning. The findings of the research are summarized for each of three dependent variables, namely, factors affecting the influence of environmental considerations in the formulation of alternatives, in the ranking of alternatives, and in the modification of a tentatively selected plan. GRA

N79-25945# Stanford Univ., Calif. Program in Infrastructure Planning and Management.
ENVIRONMENTAL CONSIDERATIONS IN THREE INFRASTRUCTURE PLANNING AGENCIES: AN OVERVIEW OF RESEARCH FINDINGS
Leonard Ortolano, Charles M. Brendecke, James E. Price, and John J. Meersman Dec. 1978 102 p refs
(Grant NSF PRA-75-22340)
(PB-292545/1; SU-IPM-6; NSF/PRA-7522340/1) Avail: NTIS HC A06/MF A01 CSCL 13B

Data from interviews with 118 planners and environmental specialists who played key roles in 68 water resources and highway planning investigations indicate that environmental information exerts a relatively strong influence on planning outcomes in studies where there is early and extensive coordination with other agencies and the public, and where environmental specialists function as active planners who communicate frequently and informally with engineering planners and who have duties including a broad range of activities rather than just activities that concern environmental impact assessment. GRA

N79-25946# Denver Urban Observatory, Colo.
IMPROVING LOCAL GOVERNMENT ACCESS TO SCIENCE AND TECHNOLOGY
1978 64 p Prepared in cooperation with Denver Res. Inst., Colo.; and Martin Marietta Aerospace, Denver
(Contract NSF ISP-75-22819)
(PB-292550/1; NSF/RA-780445; Rept-2) Avail: NTIS HC A04/MF A01 CSCL 13B

The Colorado Innovation Center (CIC) completed the second phase of its public-private technological innovation program to provide problem-solving assistance to the city and county of Denver, city of Longmont, city of Englewood, city of Aurora, city of Lakewood, and Boulder County. During 1977-1978, CIC identified over 180 technical problems and acted upon 70. GRA

N79-25947# Sala Magnetics, Inc., Cambridge, Mass.
TREATMENT OF COMBINED SEWER OVERFLOWS BY HIGH GRADIENT MAGNETIC SEPARATION: ON-SITE TESTING WITH PILOT PLANT TRAILER Final Report, Aug. 1976 - Dec. 1977
David M. Allen Dec. 1978 95 p refs
(Contract EPA-68-03-2218)
(PB-292329/0; EPA-600/2-78-209) Avail: NTIS HC A05/MF A01 CSCL 13B

Seeded water treatment using a high gradient magnetic separator pilot plant system was conducted on combined sewer overflows and raw sewage in Cambridge, MA and at on-site locations in the Boston area. Special emphasis was placed on specific design and operational parameters, long term durability and maintenance problems, and system adaptability to integrated wet and dry weather flow conditions. The on-site results reported, although not equaling those obtained on uniform batch samples in house, were nevertheless good and proved that HGMF magnetic filtration treatment system is easily adaptable to the dynamic solids loading and flow rate conditions typically associated with storm water and integrated wet and dry treatment systems. GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N79-25948 Illinois Univ. at Urbana-Champaign.
THE BINARY SYSTEM CONTAINING THE PULSAR PSR 1913 PLUS 16 AND ULTRA-VIOLET AND X-RADIATION FROM ACCRETING MAGNETIC WHITE DWARFS

Ph.D. Thesis
Albert Ronald Masters 1978 148 p
Avail: Univ. Microfilms Order No. 7913543

Ways of determining the nature of the companion to the pulsar PSR 1913+16 from observations of the pulsar's orbit and the slow rate of the orbit's precession are discussed. Geometric constraints require that the companion be a black hole, a neutron star, a white dwarf, or a helium-main sequence star. A uniform, geometrically thin slab was used to approximate the post-shock region and determine the physical conditions behind the shock when matter from a companion star falls into a white dwarf. The emitted spectrum is also determined for a range of stellar masses, magnetic fields, and accretion rates. Analytic fits to cyclotron spectra from mildly relativistic plasmas over a frequency range from one to eighty times the cyclotron frequency are calculated and derived. Observations of hard and soft X-rays are used to determine the mass and magnetic field of a star and its accretion rate. X-ray observations of AM Her, SS Cyg, and U Gem are discussed. Dissert. Abstr.

N79-25949 Iowa Univ., Iowa City.
THE ABSORPTION OF PULSAR SIGNALS BY INTERVENING NEUTRAL HYDROGEN Ph.D. Thesis
Joel Mark Weisberg 1978 190 p
Avail: Univ. Microfilms Order No. 7912918

The absorption of pulsar signals by intervening neutral hydrogen was measured with a 305-meter telescope. Eleven low-galactic latitude objects were observed. The resulting absorption spectra are used in conjunction with galactic rotation models to estimate pulsar distances. In addition, the pulsar distance estimates are combined with known dispersion measures to determine mean free-electron densities along the lines of sight. Dissert. Abstr.

N79-25950*# California Inst. of Tech., Pasadena.
FAR-INFRARED OBSERVATIONS OF H 2 REGIONS AND ASSOCIATED GALACTIC AND EXTRAGALACTIC SOURCES Semiannual Report, 1 Nov. 1978 - 31 May 1979
1979 7 p refs
(Grant NGR-05-002-281)
(NASA-CR-158695) Avail: NTIS HC A02/MF A01 CSCL 03A

Using imaging techniques maps were made at 50 and 100 micrometers with one foot resolution of a region around the galactic center about one-half degree in extent. Higher resolution maps were made of the central portion of the galaxy at 30, 50, and 100 micrometers. Resolution maps of a reflection nebula were also made. Infrared sources associated with molecular clouds were investigated. R.E.S.

N79-25951*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INFRARED RECEIVERS FOR LOW BACKGROUND ASTRONOMY: INCOHERENT DETECTORS AND COHERENT DEVICES FROM ONE MICROMETER TO ONE MILLIMETER Final Report
N. W. Boggess (NASA, Washington), L. T. Greenberg (Aerospace Corp.), M. G. Hauser (NASA. Goddard Space Flight Center), J. R. Houck (Cornell Univ.), F. J. Low (Arizona Univ.), C. R. McCreight, D. M. Rank (California Univ., Santa Cruz), P. L. Richards (California Univ., Berkeley), and R. Weiss (MIT) Jun. 1979 120 p refs
(NASA-TM-78598; A-7874) Avail: NTIS HC A06/MF A01 CSCL 03A

The status of incoherent detectors and coherent receivers over the infrared wavelength range from one micrometer to one millimeter is described. General principles of infrared receivers are included, and photon detectors, bolometers, coherent receivers, and important supporting technologies are discussed, with emphasis on their suitability for low background astronomical applications. Broad recommendations are presented and specific opportunities are identified for development of improved devices. Author

N79-25952# Lincoln Lab., Mass. Inst. of Tech., Lexington.
REAL TIME ASTROMETRY
Laurence G. Taff, Iva M. Poirier, Aubyn Freed, and Ramaswamy Sridharan 25 Sep. 1978 20 p refs
(Contract F19628-78-C-0002; AF Proj. 2128)
(AD-A061923; TN-1978-34; ESD-TR-78-273) Avail: NTIS HC A02/MF A01 CSCL 03/1

This report provides estimates of the positional accuracy for celestial objects which have been obtained at the Experimental Test Site of the Ground-based Electro-Optical Deep Space Surveillance (GEODSS) program. Optical observations made at the ETS have been compared with radar measurements performed by the Millstone Hill Radar. A brief description of the equipment and theoretical basis of the optical data reduction is included too. It appears that optical observations of artificial satellites, with real time reduction, are accurate to approximately 5 seconds. Author (GRA)

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N79-25953 California Univ., Los Angeles.
THE DETECTABILITY OF CLATHRATE HYDRATES IN THE OUTER SOLAR SYSTEM Ph.D. Thesis
William David Smythe 1979 129 p
Avail: Univ. Microfilms Order No. 7913756

Reflectance spectra of laboratory clathrate hydrates of methane, hydrogen sulfide, and carbon dioxide were taken for the purpose of determining the feasibility of detecting clathrate hydrates with remote sensing. The spectrum of a clathrate with weak guest bands only in the 1.4 or 1.9 micron region, or having bands only in the 2.5 to 7 micron region, is not distinguishable from the spectrum of a pure water frost. The broadband shape of clathrate reflectance spectra always resembles the broadband shape of pure H2O frost. Planetary implications are that only some clathrate hydrates can be detected by remote spectroscopic sensing, and that the broadband H2O frost features must appear in a planetary reflectance spectrum if a clathrate hydrate is on the planetary surface. Dissert. Abstr.

N79-25954 Illinois Univ. at Urbana-Champaign.
ACCRETION BY ROTATING MAGNETIC NEUTRON STARS Ph.D. Thesis
Pranab Ghosh 1978 215 p
Avail: Univ. Microfilms Order No. 7913468

A historical introduction to four studies, in which a theory is developed of accretion by rotating magnetic neutron stars, is provided. A detailed magnetohydrodynamic description of the accretion flow and the magnetic field configuration within the magnetosphere of the neutron star is given. It is shown that bounds on the accretion torque exerted on the star can be obtained by applying general conservation laws to the flow in the transition zone between the magnetosphere flow and the exterior flow. The location, size, and the structure of the transition zone in the case of accretion from a Keplerian disk are determined. Results are applied to pulsating X-ray sources and it is shown that the secular spin-up rates of all the measured sources can be accounted for quantitatively if it is assumed that these sources are accreting from Keplerian disks and have magnetic moments of approximately 10 to the 29th power to 10 to the 32d power. Dissert. Abstr.

N79-25955 Rensselaer Polytechnic Inst., Troy, N. Y.
THE EFFECT OF RADIATION PRESSURE ON THE FORMATION OF PLANETARY NEBULAE Ph.D. Thesis
Ronald Dennis Held 1978 73 p
Avail: Univ. Microfilms Order No. 7913074

By the investigation of very luminous red giants, analysis shows that the outer region is mass dominated and the inner regions, near the core, radiation dominated. This structure favors radiation pressure ejection. Analytical elementary models demonstrate that a thin shell of matter supported by a deep radiation cavity can have equilibrium configurations. From two equilibrium models, four hydrodynamical model envelopes were computer generated. From the output, each envelope was unstable to either dynamical or thermal perturbations, reaching several tens of kilometers per second in about ten to a hundred years. Dissert. Abstr.

N79-25956 Illinois Univ. at Urbana-Champaign.
HYDRODYNAMIC STUDIES OF THE CONSEQUENCES OF ACCRETION ONTO DEGENERATE DWARFS Ph.D. Thesis
John Lavery 1978 171 p
Avail: Univ. Microfilms Order No. 7913524

Some consequences of thermonuclear runaways which can proceed in accreted hydrogen envelopes on white dwarfs are explored in detail. An examination is made of the influences of chemical composition, accretion, convection, the delayed energy release resulting from the decay of the radioactive isotopes formed under these burning conditions, and the structure of the initial model. In the models, the characteristics of the rises in both the visual and bolometric luminosities are found to be strongly dependent both upon the details of energy transport and upon variations in the rate of energy production. Based upon these calculations, it is confirmed that significant carbon enrichment of the envelope is necessary for rapid mass ejection.
Dissert. Abstr.

N79-25957 California Univ., Santa Cruz.
FRAGMENTATION OF ROTATING PROTOSTELLAR CLOUDS Ph.D. Thesis
Joel Edward Tohline 1978 164 p
Avail: Univ. Microfilms Order No. 7911945

Through numerical modeling, the behavior of rotating, isothermal gas clouds as they collapse from Jeans unstable configurations is examined in an attempt to determine whether they are susceptible to fragmentation during the dynamic collapse phase of their evolution. Nonaxisymmetric fragmentation in collapsing, rotating gas clouds are also examined. A 3-D hydrodynamic computer code is described that was developed to study the problem numerically. It was found that rotating gas clouds in which pressure forces play a nonnegligible role are not susceptible to nonaxisymmetric fragmentation during a phase of dynamic collapse. The work favors a picture of star formation in the galactic disk which permits fragmentation of a gas cloud only during quasi-equilibrium phases of its evolution.
Dissert. Abstr.

N79-25958 Institut d'Aeronomie Spatiale de Belgique, Brussels.
INTERPLANETARY MAGNETIC HOLES: THEORY
L. F. Burlaga (NASA. Goddard Space Flight Center) and J. F. Lemaire 1978 20 p refs Presented at Spring Ann. Meeting of the AM. Geophys. Union, Wash. D. C., 30 May-3 Jun. 1977 Sponsored in part by Maryland Univ. Submitted for publication (Aeronomica-Acta-A-189-1978) Avail: Issuing Activity

Magnetic holes in the interplanetary medium are explained as stationary, nonpropagating, equilibrium structures in which there are field-aligned enhancements of the plasma density and/or temperature. Magnetic anti-holes are considered to be associated with depressions in the plasma pressure. In this model, the observed changes in the magnetic field intensity and direction are due to diamagnetic currents carried by ions which drift in a sheath as the result of gradients in the magnetic field and in the plasma pressure within the sheath. The thicknesses of the sheaths considered were approximately a few ion Lamor radii. An electric field is normal to the magnetic field in the sheath. Solutions of Vlasov's equation and Maxwell equations are presented which account for several types of magnetic holes observed, including null-sheets. Author (ESA)

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N79-25959*# TRW Defense and Space Systems Group, Redondo Beach, Calif.
COMETARY PARTICULATE ANALYZER Final Report
J. F. Friichtenicht, D. J. Miller, and N. G. Utterback May 1979 56 p refs
(Contract NASw-3151)
(NASA-CR-158705; TRW-32126-6001-RU-00) Avail: NTIS HC A04/MF A01 CSCL 03B

A concept for determining the relative abundance of elements contained in cometary particulates was evaluated. The technique utilizes a short, high intensity burst of laser radiation to vaporize and ionize collected particulate material. Ions extracted from this laser produced plasma are analyzed in a time of flight mass spectrometer to yield an atomic mass spectrum representative of the relative abundance of elements in the particulates. Critical aspects of the development of this system are determining the ionization efficiencies for various atomic species and achieving adequate mass resolution. A technique called energy-time focus, which utilizes static electric fields to alter the length of the ion flight path in proportion to the ion initial energy, was used which results in a corresponding compression to the range of ion flight times which effectively improves the inherent resolution. Sufficient data were acquired to develop preliminary specifications for a flight experiment. A.R.H.

N79-25960*# Texas Univ. at Austin. Electrical Engineering Research Lab.
MILLIMETER WAVELENGTH SPECTROSCOPY AND CONTINUUM STUDIES OF THE PLANETS Semiannual Status Report, 1 Oct. 1978 - 31 Mar. 1979
Paul A. VandenBout and John H. Davis 1979 50 p refs
(Grant NGL-44-012-006)
(NASA-CR-158708) Avail: NTIS HC A03/MF A01 CSCL 03B

Careful observations were made at 86.1 GHz to derive the absolute brightness temperatures of the Sun (7914 + or - 192 K), Venus (357.5 + or - 13.1 K), Jupiter (179.4 + or - 4.7K), and Saturn (153.4 + or - 4.8 K) with a standard error of about 3%. This is a significant improvement in accuracy over previous results. A stable transmitter and novel superheterodyne receiver were constructed and used to determine the effective collecting area of the MWO 4.9 m antenna relative to a previously calibrated standard gain horn. The thermal scale was set by calibrating the radiometer with carefully constructed and tested hot and cold loads. The brightness temperatures may be used to establish an absolute calibration scale and to determine the antenna aperture and beam efficiencies of other radio telescopes at 3.5 mm wavelength. G.Y.

N79-25961*# National Aeronautics and Space Administration, Washington, D. C.
ELECTRICAL DISCHARGES IN THE ATMOSPHERE OF VENUS
L. V. Ksanfomaliti, N. M. Vasilchikov, O. F. Ganpantserova, Ye. V. Petrova, A. P. Suvorov, G. F. Filippov, O. V. Yablonskaya, and L. V. Yabrova Jun. 1979 18 p refs Transl. into ENGLISH of "Elektricheskiye Razryady v Atmosfere Venere" Moscow, Acad. of Sci. USSR, Inst. of Space Res., 1979 p 1-16 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75639) Avail: NTIS HC A02/MF A01 CSCL 03B

Data received from Venera 11 and 12 experiments involving the electrical activity of the atmosphere of Venus show that the electrical discharges occur in the cloud layer. Their energy is roughly the same as in terrestrial lightning, but with a pulse repetition frequency of the discharges which is much greater.
A.R.H.

N79-25962*# National Aeronautics and Space Administration, Washington, D. C.
SPECTROPHOTOMETRIC EXPERIMENT ON THE VERERA-11 AND VENERA-12 DESCENT VEHICLES: SOME RESULTS OF THE ANALYSIS OF THE SPECTRUM OF THE DAYTIME SKY OF VENUS
V. I. Moroz, B. Ye. Moshkin, A. P. Ekonomov, N. F. Sanko, N. A. Parfentev, and Yu. M. Golovin Jun. 1979 16 p refs Transl. into ENGLISH of "Spektrofotometricheskiy Eksperiment na Spuskayemykh Apparatakh Venera-11 i Venera-12: Nekotoryye Rezultatu Analiza Spektra Dnevnogo NebaVenergy", Rept. Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1979 p 1-15 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)

(NASA-TM-75640) Avail: NTIS HC A02/MF A01 CSCL 03B

The spectra of the daytime sky of Venus were recorded on the Venera-11 and Venera-12 descent vehicles at various altitudes above the planet's surface, within the interval of 4500 to 12,000 Angstroms. The angular distribution of the brightness of the scattered radiation was recorded and the ratio of water and carbon dioxide were studied, with respect to the cloud cover boundaries. Author

N79-25963*# California Inst. of Tech., Pasadena. Radiation Lab.

ION-BEAM ANALYSIS OF METEORITIC AND LUNAR SAMPLES

T. A. Tombrello [1979] 33 p refs

(Grants NGR-05-002-333; NSF PHY-76-83685)

(NASA-CR-158698) Avail: NTIS HC A03/MF A01 CSCL 03B

Charged particle-induced nuclear reactions were used in the following problems: the determination of elemental abundances of boron and fluorine in carbonaceous chondritic meteorites; the identification of products of lunar vulcanism; and the study of solar wind-implanted atoms in lunar materials. The technique was seen as an important supplement to other methods of elemental and isotopic analysis. This was especially true for cases involving light elements at very low concentrations or where high resolution depth distribution information was needed in non-destructive analysis. R.E.S.

N79-25964*# National Aeronautics and Space Administration, Washington, D. C.

AN ANALYSIS OF THE CHEMICAL COMPOSITION OF THE ATMOSPHERE OF VENUS ON AN AMS OF THE VENERA-12 USING A GAS CHROMATOGRAPH

B. G. Gelman, V. G. Zolotukhin, N. I. Lamonov, B. V. Levchuk, L. M. Mukhin, D. F. Nenarokov, B. P. Khotnikov, V. A. Rotin, and A. N. Lipatov Jun. 1979 13 p refs Transl. into ENGLISH of Analiz Khimicheskogo Sostava Atmosfery Venery na AMS Venera-12 Gazovym Khromatografom (Moscow), 1979 11 p Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original document prepared by Academy of Sciences USSR, Moscow

(Contract NASw-3199)

(NASA-TM-75476) Avail: NTIS HC A02/MF A01 CSCL 03B

Eight analyses of the atmosphere of Venus were made beginning at an altitude of 42 km right down to the surface of the planet. The following were detected in the atmosphere of Venus: nitrogen in concentrations of 2.5 plus or minus 0.5 volumetric %, argon ir concentrations (4 plus or minus 2) x 10 to the minus 3 power volumetric %, CO--(2.8 plus or minus 1.4) x 10 to the minus 3 power volumetric % and SO2 in concentrations (1.3 plus or minus 0.6) x 10 to the minus 2 power volumetric %. The upper limits were estimated for the content of oxygen and water equal to 2 x 10 to the minus 3 power and 10 to the minus 2 power volumetric %, respectively. A.R.H.

N79-25965*# National Aeronautics and Space Administration, Washington, D. C.

MASS SPECTROMETRY MEASUREMENTS OF THE LOWER ATMOSPHERE OF VENUS

V. G. Istomin, K. V. Grechnev, and V. A. Kochnev Jun. 1979 15 p refs Transl. into ENGLISH of Mass-spektrometricheskiye Izmereniya Sostava Nizhney Atmosfery Venery (Moscow), 1978 15 p Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original document prepared by Academy of Sciences USSR, Moscow

(Contract NASw-3199)

(NASA-TM-75477) Avail: NTIS HC A02/MF A01 CSCL 03B

Mass spectrometer experiments installed on the descent vehicles of the Venera-11 and the Venera-12 are described. Data on the chemical composition of the lower atmosphere of Venus is discussed with emphasis on the isotope state of the basic components (carbon, oxygen, nitrogen) and of the inert gases. A.R.H.

N79-25966# Institut fuer Weltraumforschung, Graz (Austria).

NEW KNOWLEDGE ABOUT OUR PLANETS [NEUE ERKENNTNISE UEBER UNSERE PLANETEN]

Helmut Rucker 30 Sep. 1977 43 p refs In GERMAN Presented at Austrian Phys. Ann. Meeting, Loeben, Austria, 30 Sep. 1977 Avail: NTIS HC A03/MF A01

Data obtained by American and Russian space probes on Mercury, Venus, Mars, and Jupiter are presented. These data include information obtained during Mariner 10 encounters with Mercury dealing with the planetary surface, atmosphere, and magnetic field; Mariner 4, 6, 7, and 9 data on the Martian atmosphere and surface; the Viking tracking meteorological data; and Viking biological experiments. Data obtained from Mariner 2, 5, and 10 on the composition and structure of the Venus atmosphere and ionosphere are compared with corresponding data from Venera 4, 6, 9, and 10 space probes. Pioneer 10 and 11 data on the Jovian atmosphere, magnetic field, and magnetosphere are cited. J.M.S.

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N79-25967 Institut d'Aeronomie Spatiale de Belgique, Brussels.

THE PENETRATION OF SOLAR WIND IN THE MAGNETOSPHERE [LA PENETRATION DU VENT SOLAIRE DANS LA MAGNETOSPHERE]

J. Lemaire 1978 40 p refs In FRENCH; ENGLISH summary Presented at Soc. Belge d'Astronomie de Meteorol. et de Phys. du Globe, Belg. 26 Nov. 1977 Submitted for publication

(Aeronomica-Acta-A-188-1978) Avail: Issuing Activity

Two types of stationary magnetospheric models were produced. They are closed models and open magnetospheric models. However, none of these stationary representations is fully satisfactory when compared to magnetic field or plasma observations made over a 15 year period in the vicinity of the magnetopause. Recently, theoretical difficulties have also been emphasized for open magnetospheric models when magnetic field line merging is considered. Leaving the hypothesis of quasi-uniform solar wind densities, a mechanism is discussed for pulse penetration of plasma irregularities into the magnetosphere. Finally, magnetopause observations are illustrated which support the thesis that the interaction between the solar wind and the magnetosphere is nonstationary and that the magnetosphere can be partially and intermittently open. Author (ESA)

N79-25968 Institut d'Aeronomie Spatiale de Belgique, Brussels.

CONTROL OF PULSE PENETRATION OF SOLAR WIND IRREGULARITIES INTO THE MAGNETOSPHERE BY THE INTERPLANETARY MAGNETIC FIELD DIRECTION

J. Lemaire, M. J. Rycroft (Southampton Univ., Engl.), and M. Roth 1978 32 p refs

(Aeronomica-Acta-A-193-1978) Avail: Issuing Activity

A condition which must be satisfied for a plasma element to be captured by the magnetosphere is that the magnetization vector M carried by this plasma must have a positive component along the direction of B, the magnetic field where the element penetrates through the magnetopause. Otherwise, when $MB < 0$ the filament is stopped at the surface of the magnetopause. Thus the outcome of the interaction of the filament with the magnetosphere depends upon the orientation of the interplanetary magnetic field. Therefore, it is easier to find a place near the neutral points where the condition $MB > 0$ is satisfied than elsewhere. As a consequence, the penetration and capture of solar wind irregularities in the cleft regions is possible for almost any orientation of the interplanetary magnetic field direction. All observations made to date support these theoretical conclusions. Author (ESA)

N79-25969# Boston Coll., Chestnut Hill, Mass. Dept. of Physics.

PREDICTION OF THE PROTON FLUX MAGNITUDES FROM RADIO BURST DATA

Pradip Bakshi and William Barron (AFGL) Apr. 1978 23 p refs

(Contract F19628-76-C-0008)
(AD-A057071; AFGL-TR-78-0100; SR-2) Avail: NTIS HC A02/MF A01 CSCL 03/2

Various radio-burst and proton spectral parameters were considered as correlation variables in the development of an improved prediction scheme for the proton peak flux magnitudes. Besides the time integrated radio fluxes at individual frequencies, a frequency integration over two different ranges was used. The peak flux of protons (with energy greater than 10 MeV), their average energy and their duration were considered and a solar longitudinal correction was applied. Results lead to an improved prediction scheme and provide a better understanding of the correlation phenomena. A.R.H.

N79-25970# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
CORONAL STRUCTURE AND PROMINENCE CHARACTERISTICS RELATIVE TO INSTABILITIES IN THE SOLAR ATMOSPHERE M.S. Thesis
Joseph Francis Bryson, Jr. 21 Jul. 1978 91 p refs
(AD-A065366; AFIT-CI-79-75T) Avail: NTIS HC A05/MF A01 CSCL 03/2

An analysis of Lambda 5303 coronal filtergrams obtained from Sacramento Peak Observatory and an analysis of prominence lifetimes obtained from Fraunhofer Institute Maps and H-alpha patrol film were completed. A statistical survey of the filtergrams shows that the presence of the Lambda 5303 corona on the east limb indicates chromospheric Active Regions (AR's) coming within the earth's field of view. Comparison of the coronal features and chromospheric activity suggests a possible relationship between the definition and heights of the Lambda 5303 coronal structures and flares. Configurations and definition of the coronal magnetic fields inferred from Lambda 5303 and Mount Wilson photospheric magnetograms imply that stressed fields possibly exist in some coronal loop systems associated with the AR's. The sharper definition of some of the loops may be the result of a current-produced azimuthal field around the flux tube which confines the plasma and thus increases the density of the emitting material. A statistical study of prominence lifetimes shows that the ratio of the prominence angle from the local meridian to its length may be related to the lifetime of the prominence before eruption. GRA

N79-25971*# Stanford Univ., Calif. Inst. for Plasma Research.
THE EQUATORIAL ROTATION VELOCITY OF THE PHOTOSPHERE IS MEASURED TO BE THE SAME AS SUNSPOTS
L. Svalgaard, P. H. Scherrer, and J. M. Wilcox Oct. 1978 10 p refs
(Contracts NAS5-24420; N00014-76-C-0207; Grants NSF ATM-77-20580; NGR-05-020-559)
(NASA-CR-158710; AD-A062062; SU-IPR-766) Avail: NTIS HC A02/MF A01 CSCL 03/1

The equatorial rotation rate of the photosphere was measured at the Stanford Solar Observatory during 1976-1978 using spectroscopic data. The following points are made: scattered light has a large influence and must be taken into account properly; when this is done we find that the rotation rate from Doppler shifts agrees very well with the rate found for sunspots; and short-term fluctuations in rotation rate (i.e., from day to day) are less than or = 15 m/s and are thus within observational errors. Author (GRA)

N79-25972# National Technical Information Service, Springfield, Va.
SOLAR ECLIPSES. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Mar. 1979
Brian Carrigan Mar. 1979 173 p Supersedes NTIS/PS-78/0241; NTIS/PS-77/0250; NTIS/PS-76/0131; NTIS/PS-75/229
(NTIS/PS-79/0181/2; NTIS/PS-78/0241; NTIS/PS-77/0250; NTIS/PS-76/0131; NTIS/PS-75/229) Avail: NTIS HC $28.00/MF $28.00 CSCL 03B

The bibliography cites observations of solar radiation, solar corona, and effects on the earth's atmosphere, taken during solar eclipses. Observation from the eclipses of 1961 through 1973 are included. This updated bibliography contains 164 abstracts, 5 of which are new entries to the previous edition. GRA

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N79-25973 Stanford Univ., Calif.
X-RAY TRANSFER IN STELLAR ATMOSPHERES Ph.D. Thesis
Steven Henry Langer 1979 154 p
Avail: Univ. Microfilms Order No. 7912383

The problem of the radiative transfer of hard X-ray photons in stellar atmospheres is solved for several interesting systems via a Monte Carlo technique. In impulsive solar X-ray burst, radiation reflected off the photosphere greatly affects the directional properties and also modifies the spectrum and polarization predicted by flare models. In X-ray binary systems radiation reflected off the optical companion produces iron lines and a reflected continuum which may be analyzed for information about the system geometry, permitting the properties of the primary assigned on the basis of the spectral type and the Doppler curves to be checked. Dissert. Abstr.

N79-25974*# National Aeronautics and Space Administration, Washington, D. C.
ON THE VARIABILITY OF EXTRAGALACTIC SOURCES IN THE DECIMETER RANGE AND THEIR CORRELATION WITH GALACTIC STRUCTURES
N. Ya. Shapirovskaya May 1979 19 p refs Transl. into ENGLISH of O Peremennosti Vnegalakticheskikh Istochnikov v Detsimetrovom Diapazone i Ikh Korrelyatsii s Galakticheskimi Strukturami (Moscow), report Pr-422, 1978 p 1-22 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original document prepared by Academy of Sciences USSR, Moscow
(Contract NASw-3199)
(NASA-TM-75628) Avail: NTIS HC A02/MF A01 CSCL 03B

It is shown that all of the extragalactic radio sources presently known are variable in the decimeter range (lambda > or = 30 cm) and are projected on the large continuum radio structure of the galaxy: loops, spurs, ridges. Probability that coordinates could coincide is > or = 10 to the minus 7 power. The variations in the intensity are explained by scintillations (regime of focusing radiation) on the large-scale irregularities of electron density in the medium of loops, spurs and ridges with the dimension a magnitude of approximately 10 to the 13th power cm. A correlation of the characteristics of radiation of the sources with their position relative to the galactic loop is considered. Based on the known experimental data, it is shown that the angle of scattering of extragalactic radiation and the dispersion measures of pulsars projecting on the loops is considerably larger than those of the sources lying outside the loops. Author

99 GENERAL

N79-25975# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
AIR FORCE TECHNICAL OBJECTIVE DOCUMENT FISCAL YEAR 1980
Vincent L. Donla Dec. 1978 31 p Supersedes AFML-TR-77-200
(AD-A064710; AFML-TR-78-195; AFML-TR-77-200) Avail: NTIS HC A03/MF A01 CSCL 05/1

This Technical Objective Document was prepared by the Air Force Materials Laboratory (AFML) and describes the Materials Technology Areas for meeting future Air Force operational needs.

The six Technology Areas encompass the full spectrum of materials capabilities required for future aircraft, missile, space, and electronic systems - Thermal Protection Materials; Aerospace Structural Materials; Aerospace Propulsion Materials, Fluid, Lubricant, and Elastomeric Materials; Protective Coatings and Materials; and Electromagnetic Windows and Electronics. Presented for each TA is the general objective, specific goals, technical approaches, and a Laboratory TA focal point who can facilitate face-to-face discussions with Laboratory engineers and scientists. Author (GRA)

N79-25976# Consiglio Nazionale delle Ricerche, Rome (Italy). Committe for Space Research.

SPACE RESEARCH ACTIVITY IN ITALY

A. M. Sheggi 1978 19 p refs

Avail: NTIS HC A02/MF A01

The activities of the 24 Italian organizations working on space research are briefly reviewed. The main programs of each of these organizations are described as well as some of the most important results obtained. Author (ESA)

N79-25977# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).

TECHNIQUES FOR DATA HANDLING IN TACTICAL SYSTEMS, 2

I. J. Gabelman, ed. Apr. 1979 355 p refs Proc. of the Avionics Panel Symp., Monterey, Calif., 18-21 Oct. 1978 (AGARD-CP-251; ISBN-92-835-0233-7) Avail: NTIS HC A16/MF A01

Thirty-two papers apportioned as follows: two on operational requirements; six on data acquisition, display and control; six on communications; four on tactical data processing hardware; six on applications programming; and eight on tactical systems. For individual titles, see N79-25978 through N79-26008.

N79-25978# Shape Technical Center, The Hague (Netherlands).

EXPLOITING TECHNOLOGY FOR OPERATIONAL DECISIONS **c82**

I. R. Mirman *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 6 p refs (For primary document see N79-25977 16-99)

Avail: NTIS HC A16/MF A01

The needs of the tactical decision maker, and to that end, rather than discuss technology per se, the needs of the C2 decision maker were addressed. The notion that C2 is a closed-looped, servo-like system with appropriate feedback was introduced. Past problems were, to a large degree, driven by acquisition of hardware prior to evolving a C2 process needed to achieve adequate opportunity to perform both the command and the control function. Additionally, the notion that C2 was heavily communications oriented have resulted in a huge input of data, not necessarily information. Little attention was given to the orderly process needed; defining of information needed to achieve a given decision. J.A.M.

N79-25979# Naval Air Systems Command, Washington, D. C.

AVIONICS TECHNOLOGY FOR TACTICAL DATA HANDLING **c06**

E. B. Beggs *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 8 p (For primary document see N79-25977 16-99)

Avail: NTIS HC A16/MF A01

Trends emerging in Naval Aviation are discussed, along with their impact on avionics community. New avionics concepts are discussed, with emphasis on the technical and managerial challenges which must be met to assure their successful implementation. These challenges include the software implementation of distributed network control and fault tolerance; NATO interoperability and standards; and logistic support. J.A.M.

N79-25980# Cranfield Inst. of Technology Bedfordshire (England). School of Electronic System Design.

SOME TRENDS IN DATA ACQUISITION DISPLAY AND CONTROL **c82**

John T. Shepherd *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 27 p refs (For primary document see N79-25977 16-99)

Avail: NTIS HC A16/MF A01

Active and passive sensor systems were reviewed, as well as the display and control technologies available. In particular, uncooled FLIR and microwave radiometry trends were examined in the field of data acquisition and CRTs, LLD arrays, liquid crystals, and plasma panels were considered in the display area. Examples were drawn from the fields of air-to-air combat and RPV control to illustrate the differences and similarities between tactical system requirements in different areas. These examples were also used to illustrate some of the outstanding problem areas. The need for standard system description languages and interface specification to aid the total system design is also described. J.A.M.

N79-25981# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.

THE REAL-TIME TACTICAL RECONNAISSANCE DATA HANDLING PROBLEM **c43**

Henry Lapp *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 6 p refs (For primary document see N79-25977 16-99)

Avail: NTIS HC A16/MF A01

Target acquisition through classification tasks were analyzed and the machine processing and data screening techniques, that are applicable were examined. The data handling capabilities of an onboard operator and ground based image interpreter were compared. A philosophy of processing data to get information as early as possible in the data handling chain was examined in the context of ground exploitation and dissemination needs. Examples of how the various real-time sensors (screeners and processors) could fit into this data handling scenario are discussed. Specific unclassified DOD programs will be used to illustrate the credibility of this integrated approach. J.A.M.

N79-25982# Plessey Radar Ltd., Addlestone (England).

TACTICAL RADAR FOR AIR DEFENSE **c32**

R. N. Oldfield *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 16 p (For primary document see N79-25977 16-99)

Avail: NTIS HC A16/MF A01

A tactical radar system is described whose design is based on the wide use of digital data processing. These techniques have replaced analog and manual techniques in many areas, notably those of communications and radar control. In many respects, there was a shift away from the traditional approach of designing a radar and adding a data processing subsystem. In the AR3D system, the radar, data processing, and display and communications subsystems were designed together, with the data processing subsystem providing many control functions within the other two subsystems. This approach has resulted in the conversions from analog to digital signals on input (and vice versa on output) being moved closer to the input and output devices themselves (e.g. the radar, displays, air-ground-air radio equipment) making the overall system predominantly digital in nature, with consequential improvements in reliability, simplicity in manufacture and ease of deployment. J.A.M.

N79-25983# Mitre Corp., McLean, Va.

IMPROVEMENTS IN THE MAN-MACHINE INTERFACE FOR DATA ACQUISITION, DISPLAY AND CONTROL **c54**

Warren A. Manison *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 14 p refs (For primary document see N79-25977 16-99)

Avail: NTIS HC A16/MF A01

A method is discussed for improving the man-machine interface in civil and military data automation capabilities. The method combined existing hardware technology with innovative software features to provide an interactive capability responsive to the system user. Integral to the concept was the use of a touch entry device and a tabular display for message composition and entry. One or more tabular displays were used for the presentation of data forced to the position or requested by the user. Support software is discussed, including the use of implied logic designed to facilitate the message entry process, branching logic to guide or prompt the user in formatting messages for entry to the system, and display logic responsive to the needs of the position. Techniques for application of this technology to a real-time system like Air Traffic Control are described. Potential application to other types of systems was identified. J.A.M.

N79-25984# Fraunhofer-Gesellschaft, Karlsruhe (West Germany).
INTEGRATING SENSORY INFORMATION IN A MULTISENSOR SYSTEM FOR BATTLEFIELD SURVEILLANCE c43
D. Paul and T. Partman *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 7 p ref (For primary document see N79-25977 16-99)
Avail: NTIS HC A16/MF A01

This study prepared the development of an all-weather reconnaissance system for tactical ground to ground missions. At present, passive electrooptical sensors (TV, LLLTV, FLIR), active microwave sensors (tracking radar RATAC,3-D-radar), and a passive microwave radiometer were combined to form a multisensor system. Two problems were solved: (1) The display of information of the 3-D radar--this was done by showing a horizontal and a vertical slice of the spatial scene to the observer who can select the position of the slices, as well as the displayed depth range. (2) The integration of sensory information from the different sensors--this task essentially was solved by marking spatially corresponding regions in the different pictures by means of auxiliary lines. J.A.M.

N79-25985# Northrop Corp., Hawthorne, Calif. Electronics Div.
TACTICAL RECONNAISSANCE WITH IMAGE EXPLOITATION c43
Gary L. Wycoff *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 7 p refs (For primary document see N79-25977 16-99)
Avail: NTIS HC A16/MF A01

To practically and economically achieve the capability for exploitation of digital imagery in real time, the performance requirements of the ground processing facility must be carefully established. Examinations must be made of the need for various image handling techniques and the resulting benefit to the image interpreter. Through the selective use of current and planned technologies, an imagery exploitation cycle time of less than three minutes from receipt of imagery through report generation appears to be realistic. J.A.M.

N79-25986# Hughes Aircraft Co., Fullerton, Calif.
THE ROLE OF ADVANCED TECHNOLOGY IN TDMA SYSTEMS c32
Frank Amoroso and John D. Olsen *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 23 p refs (For primary document see N79-25977 16-99)
(Contracts DAAB07-76-C-1750; F19628-75-C-0205)
Avail: NTIS HC A16/MF A01

The technology in two TDMA systems is reviewed, as well as Hughes' projections of impacts of technology trends on such systems. The signal processing techniques included direct sequence pseudonoise modulation, frequency hopping, interleaved forward error correction coding, and residual error detection coding. Circuit applications include: (1) programmable matched filters for burst message preamble reception, (2) small sized, precise, agile, rapidly stabilizing, digitally controlled frequency synthesizers, (3) digital symbol demodulators, (4) surface acoustic wave devices, and (5) automated network management. J.A.M.

N79-25987# Rome Air Development Center, Griffiss AFB, N.Y.
MULTI-FUNCTION COMMUNICATIONS AND TACTICAL DATA LINKS c32
Henry J. Bush *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 11 p refs (For primary document see N79-25977 16-99)
Avail: NTIS HC A16/MF A01

By integrating temporal and spatial signal processing, the multifunction communications requirements can be generally met with moderate bandwidths. By proper design, fully adaptive transceivers with a single spectrum signalling structure can be derived with multimission capabilities. Such transcdivers at moderate bandwidths were realizable by incorporating the new solid state, programmable, signal processing device technologies and microcomputer technology. The multimission capability led to large transceiver production buys and standardized the form, fit and function (F3) parameters. Moderate bandwidths with solid state implementation minimized these F3 parameters. A single spread spectrum signalling structure led to duplicity of circuits, increasing the use of mass production processes. All of these factors combined not only lead to low cost transceivers but also to lower overall vehicle costs. J.A.M.

N79-25988# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. Department of Electrical Engineering.
INTERACTION OF ANTENNA ARRAYS AND MODEMS IN TACTICAL LINKS c32
Stanley R. Robinson, Edward Raska, Jr., and Jurgen O. Gobien (Rome Air Development Center, Griffiss AFB, N. Y.) *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 11 p refs (For primary document see N79-25977 16-99)
Avail: NTIS HC A16/MF A01

The effect of the antenna array on a wideband signal was investigated; of special interest was signal distortion produced by the nulls of the array. An analytical model was developed to relate array characteristics and the matched filter output for a wideband coherent receiver. The distorted output was written as the sum of the desired autocorrelation function and its derivatives. If the signal is being nulled, the derivatives can easily predominate and distortion become severe. Results were specialized to the case of a pseudo-noise - coded carrier filtered by a four-element linear array. A comparison with experimental data was made, and several conclusions regarding receiver design and signal choice were drawn. J.A.M.

N79-25989# Kongsberg Vapenfabrikk A/S (Norway).
BUDOS: A MULTIPLEX DATA BUS TRANSMISSION SYSTEM c82
S. Oderud *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 12 p (For primary document see N79-25977 16-99)
Avail: NTIS HC A16/MF A01

The highway or serial date bus format is appropriate to systems where data sources and users are distributed. One interface specification STANAG 4156 and one data transmission system BUDOS under development will fulfill the requirement of STANAG 4156. The polling-contention type format used for this new system will give system advantages and then one bus data channel will give system redundancy and gradual degradation. The new data distribution system BUDOS will go onboard coast guard vessels under construction in NORWAY and will be used for ordinary point-to-point addressed data and broadcast transmission. J.A.M.

N79-25990# Admiralty Surface Weapons Establishment, Portsdown (England). Computer Div.
ADNET: AN EXPERIMENTAL INFORMATION DISTRIBUTION SYSTEM c82
T. D. Wells and M. G. Stainby *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 9 p (For primary document see N79-25977 16-99)
Avail: NTIS HC A16/MF A01

The ADNET (Action Data Net) is a laboratory-based feasibility model of a shipborne command and control system. It is intended to allow examination and solution of problems associated with the introduction of distributed computing techniques to Naval Systems in such a way as to allow flexibility of major weapon systems and reconfigurability of command functions. This paper describes the hardware implementation of the information distribution system around which ADNET is based. J.A.M.

N79-25991# Naval Air Development Center, Warminster, Pa.
THE APPLICATION OF STRUCTURED DESIGN AND DISTRIBUTED TECHNIQUES TO AVIONICS INFORMATION PROCESSING ARCHITECTURES c06
Louis A. Naglak and William M. Norr *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 17 p refs (For primary document see N79-25977 16-99)
Avail: NTIS HC A16/MF A01

Structured design principles were used in the formulation of a methodology for systems design and applied to the definition of avionics processing architectures. The task was an effort to take advantage of technology advances in the computer field and structured support in software to reduce life cycle costs of avionics. A core avionics was defined and the design constraint imposed upon it discussed. The structured procedure and the way in which it was meant to take advantage of technology

was explained. Impact of standard is presented and also a specified scheme for implementation. Alternatives for development and acquisition methods and contracting for a generic avionics score are presented. J.A.M.

N79-25992# GTE Sylvania, Inc., Needham Heights, Mass. Communication Systems Div.
TACTICAL AUTOMATED MESSAGE PROCESSING SYSTEMS c62
Ruth Nelson and Joseph Jarzembowski *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 7 p refs (For primary document see N79-25977 16-99)
Avail: NTIS HC A16/MF A01

Some possible approaches are discussed to providing tactical message handling services and their effects on the design of both the tactical and strategic systems. The message handling requirements for both large WWMCCS command centers and small battlefield centers were analyzed and the implementation constraints of tactical systems and differences in emphasis for the various systems were evaluated. If automated message handling is to meet its goal of improved writer-to-reader communications, it is imperative that both strategic and tactical systems designers consider the issues of allocation of functions and of tactical/strategic interoperability. J.A.M.

N79-25993# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
[A TERMINAL FOR THE COMMUNICATION OF TACTICAL ALPHANUMERIC INFORMATION] [TERMINAL DE COMMUNICATIONS TACTIQUES D'INFORMATIONS ALPHANUMERIQUES] c62
G. Joseph (Sintra France) *In its* Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 18 p In FRENCH (For primary document see N79-25977 16-99)
Avail: NTIS HC A16/MF A01

A terminal integrated in the ATILA (automization of fire and artillery liason) system has one or more dialog posts (screens and alphanumeric keyboard). The operator in charge of targets, works on a grid whose format was designed to minimize human errors, reduce the time of formation, and increase the speed of evaluating decisions. The terminal serves to automize the fire, as a network for data transmission, a means of message transmission, and as an aide in command. Topics covered include the structure of the terminal; functional organization - environment conditions; the logic of the terminal; management of transmissions; and maintenance. The various networks of ATILA are illustrated. Transl. by A.R.H.

N79-25994# Le Materiel Telephonique, Boulogne-Billancourt (France).
NEW GENERATIONS OF TACAN MATERIALS [NOUVELLES GENERATIONS DE MATERIELS TACAN] c04
J. C. Joguet *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 10 p In FRENCH (For primary document see N79-25977 16-99)
Avail: NTIS HC A16/MF A01

A fourth generation of onboard equipment is described which uses programmed logic and microprocessors in the processing of video signals. In addition, the development of UHF semiconductors makes possible the transistorization of the most powerful equipment. On board TACAN equipment which extracts signals form ground beacons which contain information about bearing and distance benefits especially from the new technologies. The advance from logic cables to programmed logic permits effective smoothing of data regarding navigational objective as well as calculation of the navigational objective itself. The logic is divided into four parts; three for processing (azimuth, distance, and navigation) and one management monitor which accounts for the different modes of operation. The principal advantage of the completely transistorized equipment, which uses the UHF transistors, is the reduction of power loss. Cooling by forced air is not required. Transl. by A.R.H.

N79-25995# Rome Air Development Center, Griffiss AFB, N.Y.
DATA PROCESSING OPPORTUNITIES 1980 - 1990 c60
Alan R. Barnum *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 8 p refs (For primary document see N79-25977 16-99)
Avail: NTIS HC A16/MF A01

The automation of Command and Control and the associated data processing interoperability problems are discussed. Discipline of the software programming environment, cognitive aids and knowledge based systems, and distributed data processing are described. S.E.S.

N79-25996# Royal Netherlands Navy, Nieuwe Haven (Netherlands). Centre for Automation of Weapon and Command Systems.
SOFTWARE FOR ROYAL NETHERLANDS NAVY c61
Johan B. F. Tasche *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 16 p refs (For primary document see N79-25977 16-99)
Avail: NTIS HC A16/MF A01

The experience gained by the in house development of real time software for large shipborne command and control systems for the Royal Netherlands Navy (RNLN) is presented. The RNLN's both feet-on-the deck approach to the problem of finding a path through the software engineering jungle is described. S.E.S.

N79-25997# General Research Corp., Santa Barbara, Calif.
RESOURCE ANALYSIS FOR DATA-PROCESSING SOFTWARE c61
Edward N. Dodson *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 11 p refs (For primary document see N79-25977 16-99)
Avail: NTIS HC A16/MF A01

Life cycle cost relationships for data processing software are summarized. Statistical analysis based upon actual experience on weapons and space programs is discussed. Cost estimates for the major phases of the software life cycle, and for major variations in software characteristics and acquisition-management concepts are presented. Specific impacts on software cost are described for (1) the effects of hardware capacity-constraints, (2) the effects of execution-time constraints, (3) choice of language type, and (4) use of structured programming procedures. S.E.S.

N79-25998# Admiralty Surface Weapons Establishment, Portsmouth (England).
WORKING WITH TECHNOLOGY: DISTRIBUTED PROCESSING STANDARDS FOR THE EIGHTIES c60
B. R. Glaman, K. Jackson (Royal Signals and Radar Establishment, Malvern, England), R. C. Makin, D. Nairn, R. S. Newton (Royal Signals and Radar Establishment, Malvern, England), and T. D. Wells *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 11 p (For primary document see N79-25977 16-99)
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A set of standards for the adoption of which should allow computer based military equipments from a variety of sources to be developed in compatible fashion is described. The increase in the current logistic and training problems of the Armed Forces without these standards is discussed. S.E.S.

N79-25999# Singer Co., Wayne, N. J.
PARNAS PARTITIONING c06
Austin J. Maher *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 11 p refs (For primary document see N79-25977 16-99)
Avail: NTIS HC A16/MF A01

The Parnas Partitioning technique and its application to avionic software by the use of examples was reviewed. The most successful use of the technique for weapon systems is described which required participation by the software design engineer, the systems design engineer, the customers project engineer, and the end user. The role of each of these participants is identified. S.E.S.

N79-26000# Rome Air Development Center, Griffiss AFB, N.Y.
HIGH ORDER LANGUAGE STANDARDIZATION c61
S. A. DiNitto, Jr. *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 8 p refs (For primary document see N79-25977 16-99)
Avail: NTIS HC A16/MF A01

The attempts at High Order Programming Languages (HOLs) in the software environment and within the military were reviewed.

The reasons for this situation and the rational for approaches to HOL standardization are discussed from the historical, technical, and political standpoints. S.E.S.

N79-26001# Plessey Radar Ltd., Addlestone (England).
PROJECT WAVELL **c32**
R. J. Fairchild *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 10 p (For primary document see N79-25977 16-99)
Avail: NTIS HC A16/MF A01

A battlefield Command and Control Information System is described. The orgins of the requirement, the procurement policy, and the configuration and functions of the system are outlined. S.E.S.

N79-26002# RCA Government Systems Div., Moorestown, N. J. Advanced Programs Development.
MOBILE TACTICAL C TO 3RD POWER SYSTEMS **c32**
David Shore *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 5 p (For primary document see N79-25977 16-99)
Avail: NTIS HC A16/MF A01

A system with a modular van housing intelligent terminals, a miniprocessor with high density mass memories, multiplexed internal wiring to permit rapid changes of equipment, and an anti jam communication is presented. The requirements and baseline concepts of mobile tactical C3 are discussed. S.E.S.

N79-26003# Army Avionics Research and Development Activity, Fort Monmouth, N. J.
AIRBORNE DATA TRANSFER SYSTEM (ADTS) **c32**
Charles J. Stuppi, Jr. and Lockwood W. Reed *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 17 p (For primary document see N79-25977 16-99)
Avail: NTIS HC A16/MF A01

An advanced technology base for data information handling, handoff, and transfer subsystem for application to future Army aircraft systems is presented. A scout gunship target handoff scenario was designed. A computer which assimilates information from the Doppler Navigation System and Target Acquisition and Designation System and computes the UTM target coordinates is developed. Error detection and correction coding is used to assure high reliability of sending a message to reduce the probability of intercept by hostile forces. S.E.S.

N79-26004# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
PRECISION LOCATION STRIKE SYSTEM NEAR-REAL-TIME C TO THE 3RD POWER I FOR THE TACTICAL BATTLEFIELD **c32**
James T. Bowen *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 6 p (For primary document see N79-25977 16-99)
Avail: NTIS HC A16/MF A01

An all weather, near-real-time, integrated target location and strike capability by the Precision Location Strike System (PLSS) is provided. To achieve near-real-time communications, command and intelligence interface capability, the PLSS is developed with a Central Processing Communications element(CPCOM). S.E.S.

N79-26005# Kongsberg Vapenfabrikk A/S (Norway). Defense Products Div.
MSI-80S: AN INTEGRATED SMALL-CRAFT FIRE CONTROL SYSTEM **c05**
F. A. Ostern *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 15 p (For primary document see N79-25977 16-99)
Avail: NTIS HC A16/MF A01

An Integrated Fire Control System developed for fast patrol boats in the Royal Norwegian Navy is presented. The specific threat, the philosophy behind the operations aspects, and the systems engineering of the fire control systems is discussed. S.E.S.

N79-26006# Naval Weapons Center, China Lake, Calif.
JOINT TACTICAL INFORMATION DISTRIBUTION SYSTEM (JTIDS): WEAPON GUIDANCE AND WEAPON DELIVERY APPLICATIONS OF JTIDS **c05**
Claude E. Owen *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 8 p (For primary document see N79-25977 16-99)
Avail: NTIS HC A16/MF A01

The application of the JTIDS, which is a secure communications system, and tactical data processing of key data within that system, to satisfy a tactical requirement of weapon delivery is discussed. The capabilities of the JTIDS relative navigation to provide correlated time and position are described. The task of the JTIDS in solving the weapon guidance problem is reported, by placing the target coordinates into the relative navigation grid. S.E.S.

N79-26007# Le Materiel Telephonique, Boulogne-Billancourt (France).
DME TYPE DISTANCE MEASURING SYSTEMS: CURRENT STATUS AND FUTURE DEVELOPMENTS [LES SYSTEMES DE MESURE DE DISTANCE TYPE DME: ETAT ACTUEL ET DEVELOPPEMENTS FUTURS] **c04**
M. Schilliger *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 8 p refs In FRENCH (For primary document see N79-25977 16-99)
Avail: NTIS HC A16/MF A01

DME distance measurement, together with VOR, permits medium distance navigation. Its use is equally effective in landings with ILS and MLS. The principal capabilities of the system are reviewed and improvements in onboard equipment by the use of new technologies are discussed. Currently, the system is completely satisfactory, but, for the future, it may present some operational limitations which can easily be avoided. For example, the saturation of beacons is avoided by using the DME in a quasi-unique way; likewise, landing precision can be increased by the use of simple, phase-coded pulses, with the 200 supplementary channels being supplied at the same time. Precise navigation based on distance measurements is forseeable. Geographic data concerning each beacon can be transmitted on the DME channel. Transl. by A.R.H.

N79-26008# Naval Air Development Center, Warminster, Pa.
TACTICAL INFORMATION EXCHANGE SYSTEM **c82**
James R. Bonanno *In* AGARD Tech. for Data Handling in Tactical Systems, 2 Apr. 1979 10 p (For primary document see N79-25977 16-99)
Avail: NTIS HC A16/MF A01

The Communication, Navigation, and Identification (CNI) requirements of military aircraft was satisfied by an implementation of the universally accepted black box approach. This conventional solution to an increasingly complex problem has inherent limitations which have given rise to the development of a totally new system architecture. This architecture is embodied in the Tactical Information Exchange System (TIES), and it is driven by the primary goals of improving reliability, maintainability, flexibility and reducing size and weight. The unique partitioning of the system takes advantage of the latest advances in digital and RF technology and insures against premature obsolescence. Every attempt is made to share hardware resources by developing a family of multifunction programmable modules, including broadband RF components and an all digital general purpose signal processor. Efforts to date in the exploratory development program have resulted in a clear definition of the baseline architecture, fabrication of breadboard hardware for many of the key elements within the system, and theoretical analysis to evaluate various design alternatives. Ongoing work in each of these areas continues towards the ultimate goal of total system integration and validation of the TIES concept for application in the next generation of Naval aircraft. Author

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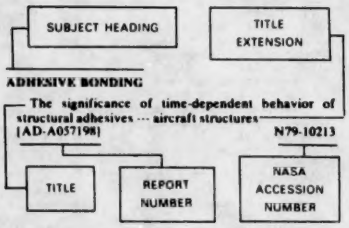

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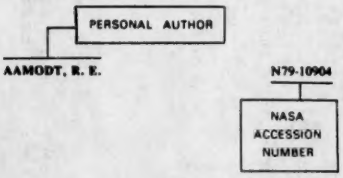

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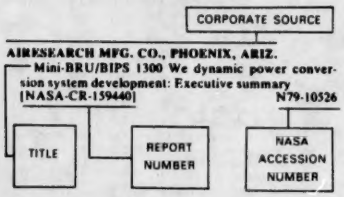

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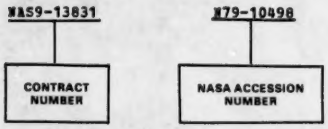

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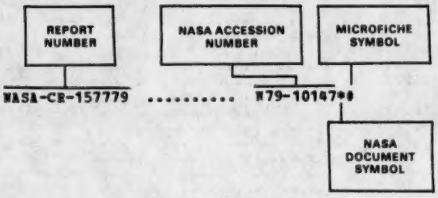

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AFAPL-TR-78-96 ..... N79-25514 #
AFAPL-TR-78-98 ..... N79-25396 #
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AFGL-TR-78-0304-PT-2 ..... N79-25637 #
AFGL-TR-78-0305-PT-3 ..... N79-25679 #
AFGL-TR-79-0021 ..... N79-25678 #

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AFHRL-TR-78-95 ..... N79-25757 #

AFIT-CI-79-75T ..... N79-25970 #

AFIT-LSSR-18-78B ..... N79-25043 #

AFIT/DS/EE/78-1 ..... N79-25763 #

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AFML-TR-77-152-PT-2 ..... N79-25236 #
AFML-TR-77-200 ..... N79-25975 #
AFML-TR-78-178 ..... N79-25198 #
AFML-TR-78-190 ..... N79-25048*#
AFML-TR-78-195 ..... N79-25975 #

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AFOSR-79-0347TR ..... N79-25148 #
AFOSR-79-0353TR ..... N79-25385 #
AFOSR-79-0365TR ..... N79-25862 #
AFOSR-79-0367TR ..... N79-25888 #
AFOSR-79-0368TR ..... N79-25267 #
AFOSR-79-0369TR ..... N79-25376 #
AFOSR-79-0370TR ..... N79-25270 #
AFOSR-79-0373TR ..... N79-25910 #
AFOSR-79-0430TR ..... N79-25292 #
AFOSR-79-0443TR ..... N79-25835 #
AFOSR-79-0450TR ..... N79-25263 #
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AFRPL-TR-77-22 ..... N79-25242 #

AFWL-TR-77-206 ..... N79-25282 #
AFWL-TR-77-207 ..... N79-25281 #
AFWL-TR-78-8 ..... N79-25881 #
AFWL-TR-78-216 ..... N79-25792 #

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AGARD-AR-135 ..... N79-24993 #

AGARD-CP-251 ..... N79-25977 #

AGARD-LS-100 ..... N79-25407 #
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AMMRC-TR-78-49 ..... N79-25150 #
AMMRC-TR-79-6 ..... N79-25238 #
AMMRC-TR-79-9 ..... N79-25406 #
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ARO-12596.8-EL ..... N79-25837 #
ARO-13321.6-C ..... N79-25232 #
ARO-13483.3-E ..... N79-25354 #
ARO-13527.1-EL ..... N79-25332 #
ARO-13622.6-M ..... N79-25800 #
ARO-13794.2-GS ..... N79-25462 #
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ARO-14363.2-E ..... N79-25206 #
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ASSA-SE-INFO-6/78 ..... N79-25527 #
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ATR-79(8408)-1 ..... N79-25375 #
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BAE-TP-7696 ..... N79-25118 #

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BNA/A-76-140-TR-82 ..... N79-25281 #
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BNFT-FB-H-77-04 ..... N79-25683 #

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CEEDO-TR-78-16 ..... N79-25251 #
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CEPHAG-34/77 ..... N79-25296 #
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CSELT-RI-78-07-302-VOL-2 ..... N79-25299 #
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C77-210.13/501 ..... N79-25379 #
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DCEC-TR-12-78 ..... N79-25280 #

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DELET-TR-77-2641-3 ..... N79-25324 #

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DOE/CS-0027/1 ..... N79-25521 #
DOE/JPL-954786-78/06A ..... N79-25484*#
DOE/JPL-954796-77/1 ..... N79-25506*#
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DOT-HS-803-722 ..... N79-25249 #
DOT-HS-803-801 ..... N79-25400 #

DOT-TSC-NHTSA-78-47 ..... N79-25249 #

DOT-TSC-UMTA-78-18 ..... N79-25936 #

DOT/FR-78/30 ..... N79-25401 #
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D180-24604-1 ..... N79-24965 #
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E-030 ..... N79-25840*#
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EPA-600/2-78-209 ..... N79-25947 #
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